EDP industry report and market review

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JULY 11, 1977 • VOL.13,NO.1 P.J.McGOVERN,PUBLISHER

Plug-compatible compendium

CDC AND HITACHI THROW THEIR HATS INTO THE PCM CPU RING WHILE ACTIVITY IN PCM DISK, TAPE, MEMORY, AND TERMINALS REMAINS BRISK

Once it was a simple world and only IBM made IBM computers. Now, it seems, everybody's getting into the business forged by Amdahl . . . CDC offers a two-model midrange PCM line manufactured by IPL Systems, a subsidiary of Cambridge Memories; Hitachi of Japan will make a large-scale (370/168-3033) CPU for Itel; and National Semiconductor has announced intentions of offering a full line of PCM mainframes.

It's a head-spinning array . . . enough to keep users, lessors, analysts, and competitors (not to mention IBM) reacting. But even while plug-compatible CPUs steal center stage, significant activity is underway in other PCM markets:

- The add-on memory market is rebounding after IBM's spring price cuts (EDP/IR,March 29,1977), as new products from National Semi, EM&M, Cambridge Memories, etc. go after new markets and at least one new supplier (CalComp) enters the fray.

- The IBM-compatible disk market (22,000 PCM 3330 spindles in the U.S. in 1976) is surging as 3350 replacements get off the ground and overseas suppliers get into the act.

- The PCM tape business, quiescent for a while, is seeing activity in the 6250 bpi end of things . . . and possible development plans for IBM 3850 Mass Storage System rivals.

- PCM terminal activity, jolted by IBM's 3270 price cuts and product line enhancements (EDP/IR,June 8,1977), is proceeding apace . . . with repricings, new products, and new functions for old products.

One of the more interesting events -- actually a nonevent -- in the PCM business this month points to the nature of the current PCM ferment: The merger between Memorex and Storage Technology. Although the deal fell through, such consolidation is likely to be an ever louder theme in the PCM business . . . as is the diversification and extension of product lines. In the long run, however, despite today's activity and optimism, such consolidation and diversification may prove to be only necessary -- not automatically sufficient -- conditions for success in the face of whatever strategies IBM develops to counter PCM inroads.

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The new PCM CPUs

Five models of plug-compatible CPUs are currently available, three from Amdahl (EDP/IR,March 29,1977) and two from Itel (EDP/IR,Oct.28,1976). Between them they span the IBM 370 line from the 145 to above the 3033. Preliminary survey results from IDC indicate that users are generally happy with their PCM computers, especially with the ease of conversion. EDP/IR estimates that 75-80 Amdahl CPUs will be installed worldwide by 12/77; over 50 were in place at the beginning of this month. Itel is currently in early shipment status, but its original order of 25 units from National Semi has been increased, and one IDC pre-3033 survey indicates that 80 systems in the U.S. by 12/78 would be a conservative forecast.

But other models will soon be available:

. . . CDC has announced the Omega 480-I and 480-II, made by IPL Systems, as 370/135-148 replacements. According to CDC, they come with a 10% to 100% increase in performance at a 5% to 30% decrease in price. The 480-I is available in 1/2, 1, 1 1/2, and 2 megabyte size; the 480-II is available in 1 and 2 megabyte sizes. The 480-I, which has already seen its first customer shipment, will start at a purchase price of $355,000; the 480-II, which will be available early in 1978, will start at $490,000. The 480s can support IBM or CDC PCM peripherals, including CDC's 38500 Mass Storage System. The CDC systems may be intended less as direct IBM replacement machines, than as extensions of CDC's peripheral line.

. . . Itel and Hitachi have announced plans to make and market a 168/3033 PCM CPU, supposedly 3-5 times as powerful as Itel's AS/5-3. Details on the system will not be released for a while (until after IBM's rumored 3032 is announced?), but the initial machine shipment from Hitachi to Itel could take place as early as next fall. Itel is also expected to expand its AS line -- made now by National Semiconductor -- sometime soon.

(Hitachi's move may be the result of intensified competition between the Japanese mainframers. A five-year program sponsored by Japan's Ministry of International Trade and Industry that helped Fujitsu and Hitachi jointly develop and manufacture the M Series of 370 competitors ended in March. According to EDP Japan Report, May 26, 1977, published by IDC, Hitachi is expected to announce a large-scale competitor to the Fujitsu M-190H and IBM 3033 this fall. The system may have connections with the Itel-Hitachi system.)

. . . National Semiconductor, Itel's supplier for the AS/4 and 5 and a major supplier of add-on memory, has formed a computer products group for the marketing of across-the-board PCM computer memories and mainframes. Indications are that the mainframes will include upward extensions of the AS line and smaller machines covering the System/3 to 370/138 gap. According to a spokesman, the company has not yet developed its marketing plans for the new models, but the options open include exclusive arrangements like that with Itel on the AS systems, non-exclusive arrangements like National Semi has with its add-on memory marketeers, or, more remotely, direct end-user marketing by the company.

So the age (however long or brief it may be) of plug-compatible computers is about to enter its second phase, where PCM vendors compete with one another as well as with IBM . . . or conversely, where plug-compatible mainframes are thrown in to sweeten PCM peripheral sales. The unknowns, of course, revolve around IBM's reactions . . . whether in price/performance curves of new products (3032? 3031?) or in unbundling along the lines of System/370 Extensions.

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Add-on memory

After a rugged two months following IBM's memory price cuts (EDP/IR,March 29, 1977), say the independent memory suppliers, business has begun to pick up again. Should IBM not lower prices again, the independents could easily reach IDC's forecasted placement of 700 megabytes of 360/370 memory (with an if-sold value of $77 million) by the end of this year. In 370 memory alone, the PCM's have over 2000 megabytes installed -- almost a fourth of all IBM 370 memory.

That the market is still as effervescent as ever can be seen by recent announcements by the major memory suppliers:

- Memorex has announced an Intersil-supplied $77,000-per-megabyte memory for the 370/158; the firm has also announced a memory family that allows 370/135-145 users to house up to 4MB in a single frame.

- National Semiconductor has announced a "multi-system bridge memory" that adapts to the entire 370 line up to the 370/168. Itel will market the new memory (National Semi previously offered 158/168 memory).

- Cambridge Memories has announced a 16 megabyte memory for 370/158s, doubling the capacity of its previous 370/158 memory.

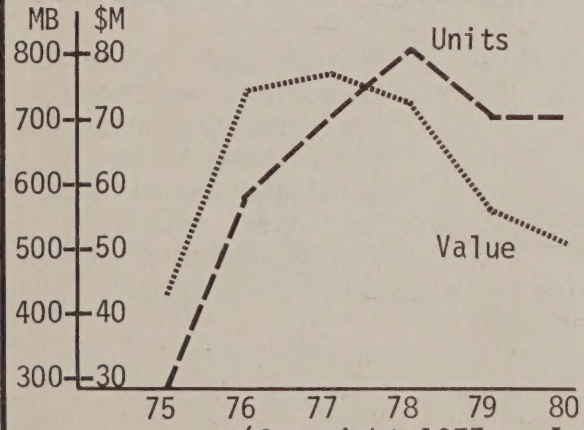
- Electronic Memories and Magnetics (EM&M) has introduced a 370/148 add-on memory that goes up to 4MB, twice IBM's capacity, for $75,000/MB.

- Intel, which delivered its 650th 370 memory last month, is said to be preparing a "universal" 370 memory for fall introduction; and trade press reports have CDC announcing 370/138 and 148 memories this year.

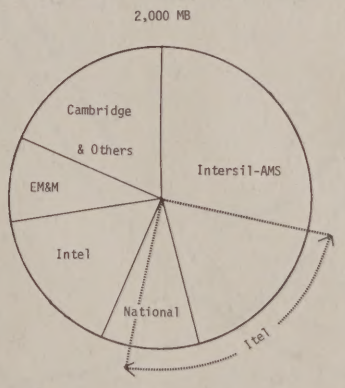
- CalComp has jumped into the ball game, announcing that it will market National Semiconductor memories to 370/158 and 168 users. Later this year, the company will extend that coverage down to the 370/135.

(Another whole memory market exists in minicomputer add-on memory. IDC forecasts that 36,500 boards will be shipped this year at a value over $40 million; by 1980, 70,000 boards will go out worth some $50 million. Plessey, Keronix, and Dataram account for over 70% of this particular independent market.)

INDEPENDENT MEMORY SHIPMENTS (U.S.)



370 MEMORY MARKET SHARE -- 1976



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SHORT COURSE ON SEMICONDUCTOR ECONOMICS

Plug-compatible CPUs, dropping memory costs, microprocessor controllers . . . behind all these advancements in computer technology lies the semiconductor revolution, and behind that the economics of production and development. For its readers, EDP/IR here digresses on those economics . . . what it is that makes the cost of those chips keep coming down.

Readers interested in more detail on semiconductor development and possibilities are urged to read "Large-scale Integration: What Is Yet To Come," by Robert N. Noyce, Chairman of Intel Corp., in the March 18, 1977, issue of SCIENCE, published by the American Association for the Advancement of Science. As a matter of fact, the whole issue is devoted to electronics and well worth reading. Many of the concepts and forecasts below are from the Noyce article.

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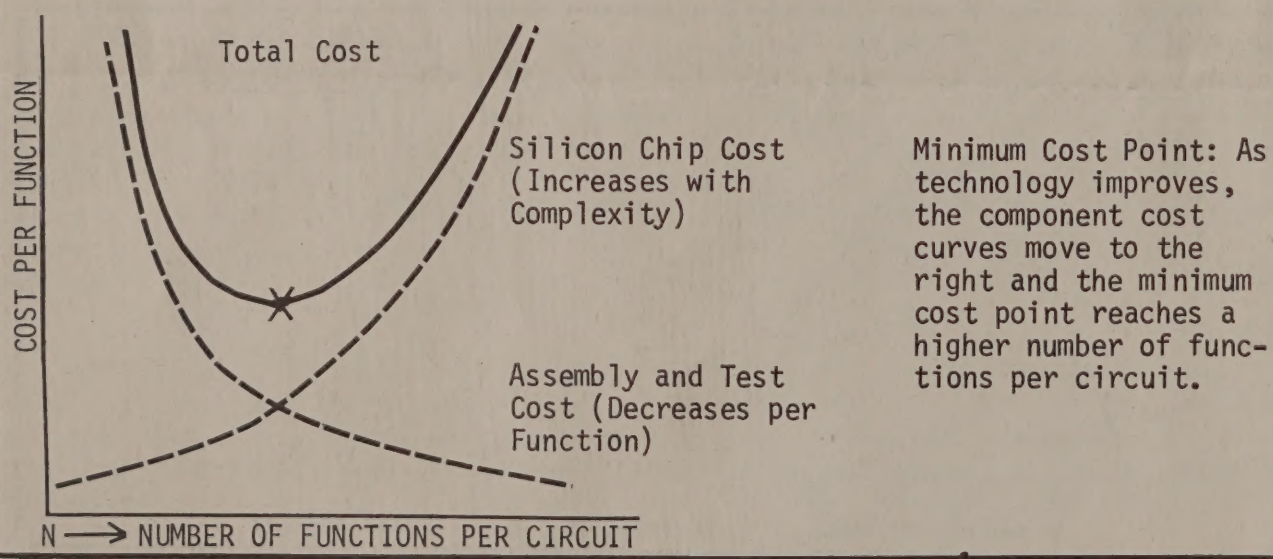
Because of the general problems inherent in electronic interconnections (power loss, noise, etc.), the packing of functions into integrated circuits has become the computer industry's answer to making ever larger and more reliable computers. The two major costs involved in IC production are 1) the cost of making the silicon chips and 2) the cost of assembling and testing the devices. (Assembly is the fitting of the active silicon element onto a housing.) In the first case, because of yield losses, increasing the number of functions -- and chip area -- increases the cost of the chip exponentially. In the second case, the cost is relatively independent of the number of functions.

As the figure below shows, the cost per function of IC manufacture has a curve in the shape of a U -- the sum of the two other curves -- with a minimum cost point. As yields get better and the manufacturing process improves, that minimum cost point moves to the right. In general, the complexity of products at the minimum cost point has doubled every year since the introduction of the integrated circuit. At the present rate, that means that within 20 years, ICs will be available with 10^9 elements.

Attaining higher levels of integration has so far been achieved primarily in three ways:

IC PRODUCTION COST



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- Increasing chip size by reducing the random defects that cause yield losses

- Introducing circuit innovations allowing higher function densities

- Making individual circuit elements smaller

Making circuit elements smaller has been the primary method of increasing integration so far and will probably remain so in the near term. Reductions by a factor of 2 have been occurring every 5 years; as dimensions are decreased, speed and density increase (and power density doesn't increase) . . . which means that circuit densities could increase by a factor of 64 and speeds by a factor of 8 in the next fifteen years.

Ultimately, combined density and chip size extrapolations point to an increase of functional complexity by a factor of 2,000 during the next 15 years, with costs increasing only slowly from those of today's complex chips . . . resulting in cost/function drops of 100 or even 1,000 to 1.

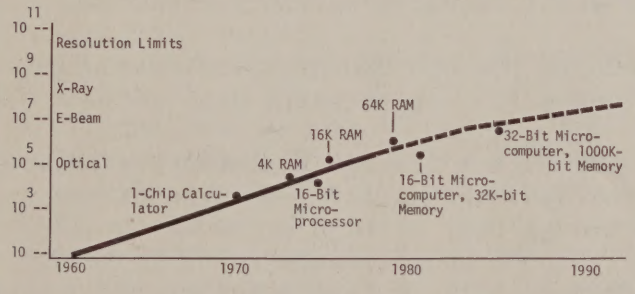
There are limits to the technology, however. Of the three methods of attaining higher integration, only increasing chip size has no fundamental limits. Results in reducing random defects have been good so far . . . and appear, in fact, to be proportional to the amount of money and effort expended in perfecting production. Of the other methods:

- Reducing circuit element size runs into the wavelength of light as a limiting factor, since the process of making chips is a photolithographic one. Alignment of successive "masks" aggravates the problem. Use of electron beams for printing and aligning "masks" is one possible way around the problem, but has not yet proven cost effective.

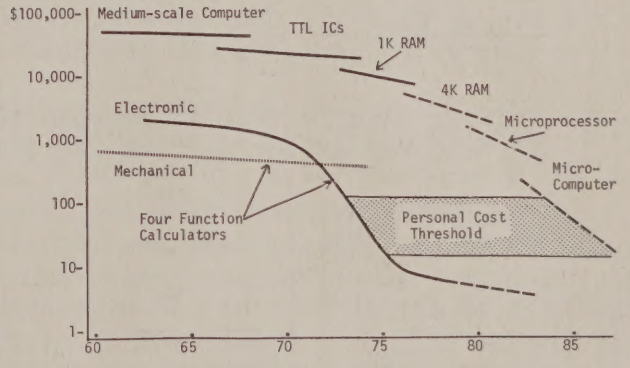
- Circuit innovations seem to be reaching a limit, but perhaps only because envisioning them is difficult. Possibilities include using three-dimensional forms or introducing redundancy at the chip level.

Still, the push continues. Minimum dimensions will continue to decrease (approaching optical limits asymptotically). Components providing 65-to-131 kilobits of memory with a 100ns access time should appear by 1981, the megabit memory chip ten years later. It's a relentless march.

SEMICONDUCTOR CHIP COMPLEXITY



COST THRESHOLDS



(Source: Texas Instruments' First Quarter and Stockholders Meeting Report -- 1976)

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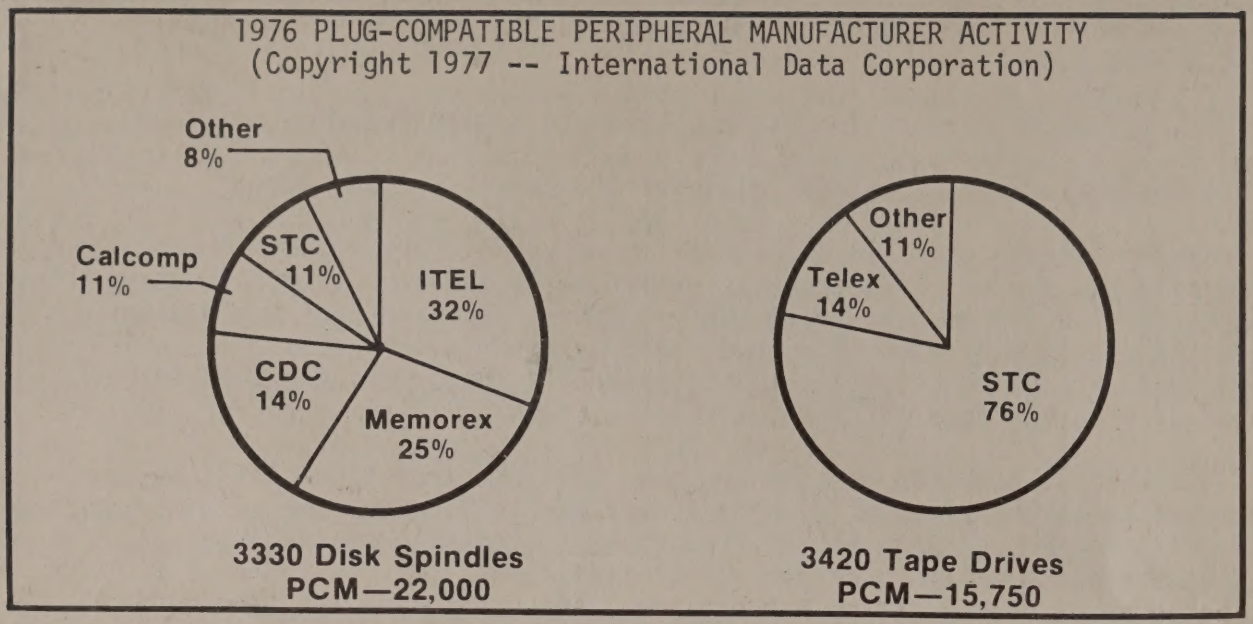

PCM disk and tape

By 1978, according to IDC estimates, computer users in the U.S. will have over 100,000 disk spindles in use . . . up from just under 70,000 in 1974. Total capacity will have more than tripled, from 6 trillion bytes to 19 trillion bytes. In 1976, about three quarters of all 87,000 spindles in use were 3330 types -- and over 35% of all 3330 type disk drives were made by non-IBM manufacturers. This year, however, is a year of transition for the disk market -- as IBM 3350 shipments hit big volumes and the independents wrestle with the problem of providing alternatives. Some recent activity:

- CDC is planning test installations of its 3350 equivalent (the 3380, a 400MB disk with 3350 emulation) within the next two months.

- Memorex will ship two orders of its 3350 equivalent disk drive this month and shoot for volume shipments by September. (It's not yet making its Winchester-style 3640, selling units made by Nippon Peripherals instead.

- Itel, which markets a Sperry Univac ISS disk called the 7330 to the 3350 market (the 7330 uses upgraded 3330 technology), will be offering a new 317.5MB ISS disk, the 7350, as a 3350 replacement.

- Nippon Electric Company's U.S. subsidiary showed a 3350-type drive at NCC; designed as an OEM product, it still requires an IBM interface.

- Fujitsu reports that it expects to enter the OEM PCM disk business with 12.7-50.8MB drives for the IBM S/1 and a 3350 drive early next year.

In the PCM tape drive business -- pretty much a Storage Technology province -- the independents have captured 34% of the U.S. market for 3420-type drives (15,750 units) as of yearend 1976. And although only a third or so of the 12/76 base of 3420 drives were of the high density (6250 bpi) variety . . . by 1978 they should account for over 40% of 3420 drives. It's not surprising, then, that the independents are concentrating their efforts in this area. Some recent market place movement:

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- CDC has indicated that it is marketing a smaller version of its 6250 bpi OEM tape drive with deliveries starting next year (Storage Technology, Telex, and Pertec all offer 6250 bpi drives).

- Memorex has introduced a mag tape subsystem that includes 6250 bpi drives and IBM controllers for 370/135s-168s (the units also operate at 1600 bpi); Fujitsu is a major supplier of the high density drives.

. . . and other PCM opportunities

As if the market for PCM devices isn't crowded enough, there are other possibilities on the horizon. Siemens, for instance, has announced a high-speed non-impact printer (EDP/IR, June 24,1977), and the trade press reports that Itel will be marketing it as a PCM replacement for the IBM 3800 in the fall. IN addition, several companies are reportedly working on IBM 3850 replacements, including Storage Technology and Fujitsu (CDC already makes a 3850 replacement).

So, the plug-compatible business is in flux, with diversification and consolidation as major themes of the marketplace. And, reviewing the announcements reported in these pages, another theme emerges . . . the extended competition from foreign suppliers, especially the Japanese. How long, one wonders, will IBM suffer the PCM impertinence? Or, put another way, how long before:

+ The PCM CPUers have to get into the operating software business?
+ A 600-800MB IBM disk drive is announced?
+ Memory prices drop again, squeezing margins further?
+ A smaller 3850 is announced, or new heirarchical memory introduced?

It may not be all that long.

\+ + + +

IBM's midrange hot cakes

370/138 AND 148 PRICE/PERFORMANCE SPURS HEAVY USER MIGRATION
360 AND 370 CAMPS ARE BOTH INFATUATED

International Data Corporation's annual survey of IBM user migration plans is almost off the line . . . and a preview report published recently indicates that the 370/138 and 148 acquisition activity reported in preliminary surveys (EDP/IR, October 1976) will be as fervent as predicted. According to the preview report, users are eagerly taking advantage of the new price/performance curves:

- 33% of current 360 CPUs will be traded in during 1977 for a 138 or 148, one of the most significant migration moves of the study. The 360 user most likely to migrate has a 360/50, second is the 360/40 user.

- 74% of the migrations planned by 370 users involved the acquisition of a 138 or 148. The 135 user had the strongest propensity to migrate, followed by the 145 user. Some 145 users are jumping up to 158s; and both the 135 and 145 rental bases are diminishing significantly. The 138/148 impact on the 125 base is almost as great as on the 145 base.

In addition to CPU swapping, IDC found that outright additions of CPUs played a much bigger role than in earlier studies. Many 145 users are adding 148s without turning in their old equipment; 158 sites not wishing to switch to the water-cooled 168 are also opting for outright additions in many cases.

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• GENERAL AUTOMATION CELEBRATES THE BIRTH OF TWINS -- the GA 16/550 shared-architecture multiprocessor with a dual cache bus and half a megabyte of error correcting memory -- that can be acquired for under $50,000. Up to 8 processors can be symetrically linked to create a large shared-memory structure with a parity/byte system that protects data transfers. The GA 16/550 also boasts microprogramming, 240 ns cycle time, and a memory management system (MMS) that addresses up to 2MB. In multiprocessor configurations, the 16/550 can reach performance levels that rival that of 370/158s and PDP-11/70s, according to GA.

In addition, GA announced the GA 16/340 and a 440 Data Series. The 16/340 utilizes LSI circuitry, microprogramming, a 450 ns 330 processor, and can accomodate 4 32KB core memory cards. The 440 Data Series features interactive multiterminal COBOL with up to 160MBs and an extremely fast compiler that can handle 16 terminals as well as other operations, making it attractive for DDP applications. Prices begin at $32,000. All three products are compatible with other GA machines.

• MITI MEANS BUSINESS when it comes to plug-compatible development. Japan's Ministry of International Trade and Industry recently expanded its aid programs to provide subsidies for the developemnt of operating systems and software, in addition to VLSI development. Until now, operating system software has been included in the price of hardware with virtually no charge to the user, but when IBM begins unbundling (already with the 3033 MVS System Extensions), Japanese makers will be forced to invest huge sums in software development. They currently spend over a third less than IBM in this vital area.

• BURROUGHS IS TRIMMING DOWN AND SHAPING UP ITS B 2800 medium-scale computers with two new high-performance models -- the B 2810 and 2815 -- that occupy one-third less floor space than their predecessors. The new iron can handle both on-line transactions and batch applications; advanced software, including Burroughs' Master Control Program, Network Definition Language, and Data Management System, is also available. The 2 MHz B 2810, with a CRT and 250KB of memory, can be purchased for just under $153,000. The 3 MHz B 2815 in a similar configurations can be purchased for just under $198,000. Deliveries will begin later this year.

• THE BRITISH ARE COMING to do battle in the U.S., namely International Computers Limited's American subsidiary is marketing the ICL System Ten 220 Series of CRT-controlled, disk-based systems here in the states. The Series 220, well-received in Europe and South Africa, will sell for $40,000 and up and offer an upgrade path for Singer System 10 users (ICL bought Singer's overseas business).

• FOUR PHASE LOOKS TO DISTRIBUTED PROCESSING WITH "VISION" and System IV/90 . . . and moves "ForeWord" in word processing. "Vision" is a transaction-oriented software package that combines DE, inquiry/retrieval, local data management, and batch communications in one system. The IV/90 features and expanded instruction set, up to 192KB of memory, and can support 32 CRTs; the CPU is twice as fast as previous models, and a typical configuration with maintenance, software support, and communications controller can lease for under $3,400 a month.

"ForeWord" is a shared logic word processing system compatible with Four Phase's Systems IV/40, 50, 70, and 90. It can support up to 16 CRTs, 16 printers, and four disk drives. With full editing capabilities, a four-station system with two disks, two printers, and a communications controller costs $315/station a month. Storage capacity ranges from 400 to 40,000 pages of text.

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Inside: NCR's Network Architecture; COM review

CONSUMER PROTECTION IN AUSTRALIA SURPRIZES THE COMPUTER INDUSTRY; U.S. COMPUTER MAKERS CEASE SIGNING CONTRACTS IN PROTEST

> Australia's $300 million a year computer industry has virtually ground to a halt in protest against the new Trade Practices Act.
>
> IBM, which handles 40 per cent of the industry's total sales, yesterday notified all customers that "until further notice we will be unable to accept new contracts for the majority of our products and services."
>
> Other major suppliers -- Control Data Australia, Honeywell Information Systems, Burroughs Ltd., Digital Equipment Australia, and Sperry Univac -- all confirmed that they had stopped accepting contracts for a wide range of their products and services from last Friday, the day the amended Trade Practices Act went into force.
>
> -- from The Australian Financial Review
> Tuesday, July 5, 1977

Although the headline on the story quoted above -- "Computer Industry 'Shutdown'" -- seems a little scary, the story behind it is true. The bulk of the U.S. computer makers doing business in Australia have ceased signing contracts while their lawyers look for loopholes in a consumer protection law called the Trade Practices Act . . . which was amended as of July 1, 1977, to include businesses selling to businesses. Formerly the act implied consumer warranties only for goods consumed for domestic or private use . . . business transactions were excluded.

Actually, the industry hasn't shut down . . . salesmen are still out beating the bushes for prospects, letters of intent are still being accepted. (As of 1/77 the Aussie installed base of general-purpose computers was $985 million, the ninth largest base outside of the U.S.) But until the amended act is clarified, the U.S. companies aren't actually signing contracts. That's not the point. The point is that all of a sudden a consumer law has scraped the flanks of an industry normally aloof from such rude interfaces with the public.

The Australian law itself apparently says that manufacturers can be sued for damages on equipment worth up to $15,000 [presumably more costly items would be warranteed under the old caveat emptor concept and common sense of the buyer], and

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AN EDITOR PONDERS . . .

In an era where EDP industry litigation has been promulgated almost to the point of absurdity, it appears that the courtroom will take on an even bigger role in the future. Aside from a bevy of cases involving patent infringements, antitrust violations, and now possibly software copyright faux pas (page 8), the emergence of some legal responsibility for computer actions (or nonactions) begins to unfold. The question of damages in the amended Australian Trade Practices Act nibbles at the fringes of it.

As we continue entwining automated machines with increasing numbers of our life-leading systems, who is to bear the responsibility if (when) the systems fail to perform? The results of such failure can transcend the economic . . . for instance in medical, food processing, or transportation (especially airlines) applications. Who is to blame if (when) death or injury results?

Is it ultimately the liability of the manufacturer? . . . or the programmer? Who's to determine whether the error was "hardwired," programmed, or simply the result of a faulty component? Are programmers, for instance, "professionals" like doctors or lawyers with the attendant responsibilities, liabilities, and ultimately malpractice premiums? Or are they merely certified technichians for whom their employers are liable?

To EDP/IR, it seems likely that more litigation looms on the horizon for the computer industry (the legal profession's overpopulated, after all). It also seems that some of it will be of a different, more thought-provoking kind.

such damages could include loss of data or stalled business operations. Thus, if a minor hardware failure brought a whole site down for a while, a manufacturer might be liable for sums greatly exceeding the cost of the failed part. To make matters worse, says one mainframer spokesman, "you can't always tell if the equipment has actually failed or it's not being used right." Hence the manufacturers' jitters over the new law. (The Australian government is being beseeched in concert for clarification of liabilities and/or exemption from the amended law.)

EDP/IR doubts that the Australian computer industry will actually grind to anything but a paperwork halt, but asks this of the U.S. makers . . . many whose U.S. offices had barely heard of the Australian brouhaha:

- In a U.S. beginning to take POS, EFTS, etc., seriously, how long before consumer laws begin to impinge on traditional ways of doing things?
- Does the trend toward unbundling, as it fragments system contractual responsibility, open the doors for unforeseen hassles?
- How does one assign a value to the data maintained by an organization? Does it have more intrinsic value if it's on-line? How much more?
- Is the value of a manufacturer's disk drive as it's used in a system contained in its hardware, its hardware and operating software, or its hardware, operating software, and data?

Finally, are these fanciful questions? . . . Or will they take on significance as computers penetrate more of our daily lives, live more at the heart of our businesses? It will be interesting to see the outcome of the Australian stir.

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Another network acronym (ANA)

NCR UNWRAPS THE DETAILS OF ITS NETWORK ARCHITECTURE INCORPORATES HDLC PROTOCOL, PACKET-SWITCHING, AND NETWORK NODES

Going from the specific (Montgomery Ward's extensive on-line network) to the general, NCR this week announced its promised network architecture, dubbed Distributed Network Architecture. Thus the Dayton mainframer joins the ranks of computer makers with official networking plans . . . and adds DNA to the alphabet soup of SNA, DSE, DSA, BDLC, etc. But despite the regularity with which the mainframers are following IBM with networking blueprints for the future, NCR's has some interesting twists. Its main features:

- Like the others' networking plans, NCR's utilizes a bit-oriented data transmission protocol (NCR/DLC) compatible with IBM's SDLC and the international standards, HDLC and ADCCP.

- Communications processing is separated from applications processing through the use of a "Data Transporting Network (DTN)" and telecommunications software (TAM) at the host.

- The "Data Transporting Network," consisting of nodal processors and internodal links, is a store-and-forward packet-switching system that provides for multiple path message routing.

- Operating software required to make DNA work (NCR/TAM, utilities, etc) will be unbundled; DNA will work with NCR products and IBM hosts running under SNA or 3270/2780-3780 bisynch protocols. (NCR is contemplating interface with Burroughs TC equipment and HIS HDLC gear.)

As with the other non-IBM network architectures, NCR's DNA provides for network control in a distributed fashion, with much of the work done by the nodal processors and terminal operating software. This allows configuration flexibility and network reliability . . . and makes it more palatable for multivendor users to link NCR terminals and nodes to IBM hosts.

Also as with the other network plans, NCR's springs from field experience -- de facto architectures being put together for existing users. Much of NCR's DNA has been predicated on Montgomery Ward's vast NCR installation (18,000 terminals on-line as of now, 25,000 by yearend, according to one NCR source). The nodal processors, for instance, are similar to the NCR 721 controllers used in the Montgomery Ward net as terminal tenders and nodal switches (and the same processors as the NCR 725 in-store controller, 605 CPU for the NCR 399).

NCR has promised the first products to be announced under DNA for fall introduction, after that DNA will be "implemented in planned stages over a period of years to meet information processing needs through the 1980s." Probably its first application will be to NCR's retail POS networks, and, inasmuch as it allows for new compatibilities and capabilities, should work well in increasing NCR's majority holdings in that market. But DNA will also be compatible with Series 8000 computers (in which modes, though [EDP/IR,May 11,1977], hasn't been spelled out) . . . making NCR's overall product line more attractive.

And even if having a formal network architecture doesn't sell any computers, not having one might do the opposite.

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On the output side

COM CONTINUES ITS STEADY GROWTH TOWARD A 1980 MARKET OF $600 MILLION
NEW FILM AND RECORD TECHNOLOGIES BEGIN TO ATTRACT ATTENTION

In an era of rising paper costs, the volume of computer output continues to increase . . . to upwards of 15 million original pages a year at an average medium- to large-scale site, according to IDC surveys. Beyond the paper costs are the costs of providing the enormous space required to store this output . . . all of which is adding to the luster of Computer Output Microfilm/fiche, which also has intrinsic archival qualities other media lack, as a cost-effective storage medium.

Indeed, COM has been clocked with a 4:1 cost and almost 100:1 space advantage over magnetic tape. And for computer users producing about 1 million original and 1 million duplicate pages per month, COM can also offer a better deal than printers . . . just under $10,000 a month for a typical COM site, $14,000 for a site with several IBM 1403N1 printers (not counting disk storage), and slightly over $18,000 for an IBM 3800 site. Moreover, in an IBM 3850 Mass Storage System accessed by 10 terminals, depending on the terminals and their usage the average monthly cost could hit $80,000.

In other words, taken against its out-of-genre competitors, COM often comes out ahead in the statistics. Still, although the first COM unit was installed in 1959, growth of the market has been relatively slow. Only 200 units had been installed by 1968, 1,000 by 1972, about 2,650 at yearend 1976. The improved momentum of the market in the last several years may be attributed to:

- An increasing need for fast, low-cost access to data. Although paper can be accessed as fast as formatted fiche, it costs more to store; and CRT access, as with an IBM 3850, costs substantially more than that.

- A COM recorder prints at faster speeds than most line printers . . . thus, film output can often be available faster than paper output.

- COM provides substantial savings in paper, storage, and mailing costs; a switch to COM is often taken as an economy measure.

And if technology breaks the right way -- or is marketed with enough savvy -- there could be further inducements for users to switch to COM or its evolutionary offspring in the future. Software for front-end minis is improving, new mass storage film systems are in prototype, and updatable film systems have been introduced or are in the works. As vendors explore what may currently seem like exotic technologies (video disk, Ovonics, Electron Beam Recording), events in industries related to micrographics (computers, office equipment) may also be spurring users to look at new and innovative methods of storing and retrieving information.

A thinning of vendors

Despite a thirteen-fold increase in the number of installed COM recorders over the past eight years, the number of COM vendors has shrunk from twenty in 1969 to nine in 1976, with CalComp marketing only overseas and Memorex marketing its old line through Quantor. The primary reason for this shakeout is the tough competition among vendors with similar recorders . . . but the high sales expense of a single recorder, and the high cost of maintaining a wide service network have exacerbated matters.

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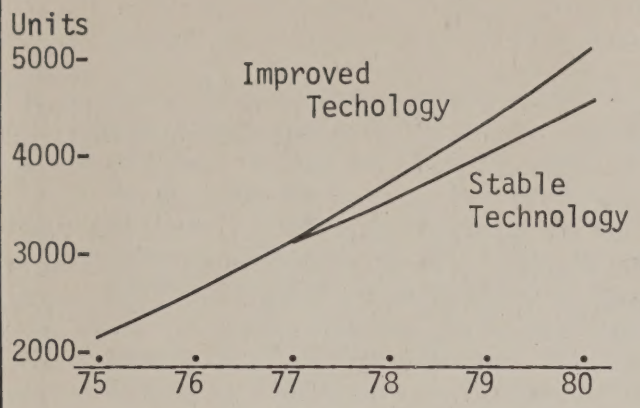
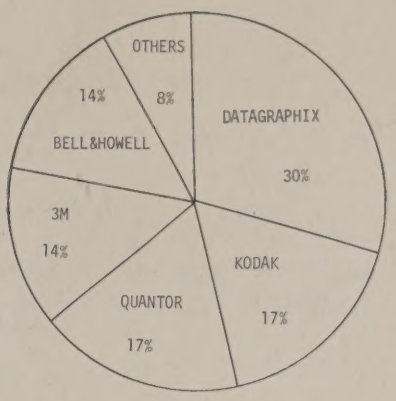
U.S. COM RECORDER FORECAST



U.S. MARKET SHARES -- 1976 EST



(Copyright 1977 by International Data Corporation)

Still, the COM industry offers potential for the vendors remaining. According to D.W. McArthur, Vice President of 3M's Microform Products Division, "The micrographics industry still has its greatest growth potential ahead -- ninety per cent of the sales we see for our new line of microfiche equipment are to customers who recognize it as a practical way to eliminate paper-based systems. This is the potential for new business, not simply replacing older systems, our own or a competitors." IDC surveys corroborate this "new business" point:

- Over a quarter of the non-service bureau COM user applications were not printed before COM was installed, about 15% of the service bureau aplications were not previously printed.

- Two-thirds of the COM sites sampled reported paper output as well as COM output growth, showing COM penetration into new applications.

- For in-house users, only 6% of the total COM output had to be duplicated with paper, for service bureau users 12%.

And, COM's increased penetration of the computer industry is borne out by more IDC statistics: At the beginning of last year just under 1/5 of the almost 60,000 general-purpose computer sites used COM . . . by 1980, it's expected that almost 1/4 of over 110,000 sites will use COM.

Catering to the user

In recent years, one of the major concentrations of vendors has been making their systems easier to use. Both Kodak and 3M have aimed their efforts at developing dry-processing, laser-based systems. 3M introduced its system in 1974, making steady improvements in it; Kodak introduced its KOMstar Series earlier this year. The advantages of dry processing are still primarily confined to ease of handling for the user -- no chemicals to mix or handle, no darkrooms — but they are not noticably faster or of higher quality than comparable "wet" systems. (In fact, dry fiche has the disadvantage of not being archival since it has a shelf life of 30 years, 20 shy of the accepted standard; it's also not suited to making massive amounts of duplicates.)

Datagraphix (formerly Stromberg-Datagraphix, a subsidiary of General Dynamics), the market share leader in COM and Quantor, the only COM vendor without oth-

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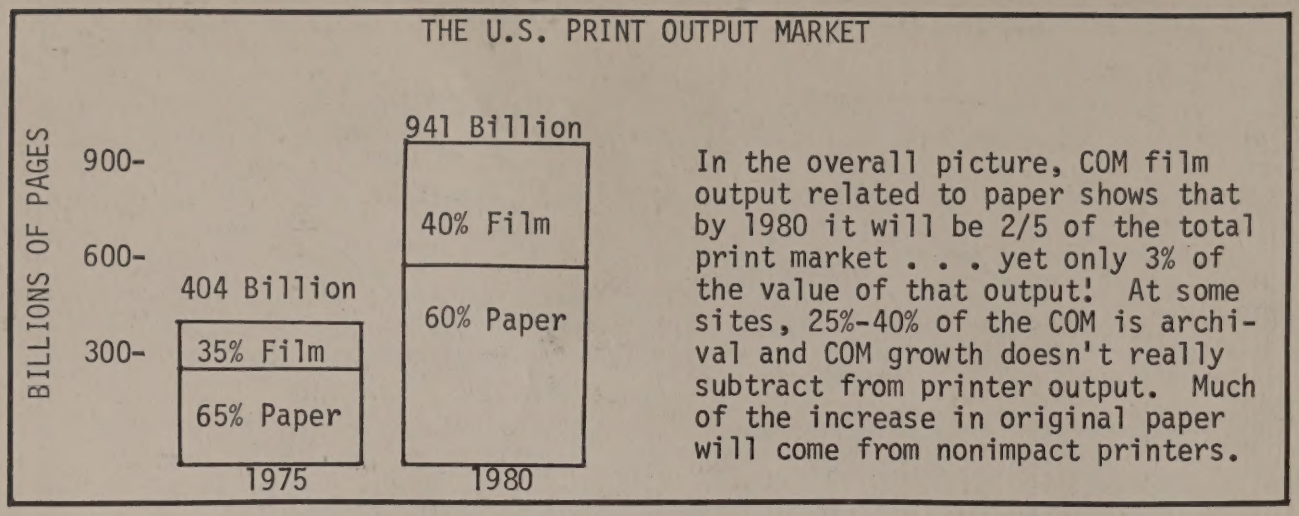

er manufacturing interests or parent company, have pursued ease-of-use in another direction. Datagraphix recently introduced AutoCOM, which, although it utilizes a "wet" process, takes advantage of in-line processing and involves no "people-handling" of the film. And Quantor's 115, which saw first deliveries last year, uses an NCR minicomputer to help it format, record, cut, develop, and deliver completed microfiche in one step. (IDC, in fact, sees the Datagraphix AutoCOM as almost an exact duplicate of Quantor's older 105. Both are fiche-only, low-cost devices without front-end minis that cater to in-house users with no graphics need.)

Updateable microfilm systems

One of the current drawbacks of COM is its fixed nature . . . you can't write on it. Recently, however, several companies have been experimenting with updateable film systems -- units which produce film output from paper copy which can be written on, added to, or erased. Once microfilm systems are developed with this capability, their extension to COM applications can be readily seen . . . perhaps as on-line mass storage retrieval systems, perhaps as archival storage only. So far the major vendors of updateable systems are:

- A.B. Dick/Scott Graphics -- with the only system now on the market, the System 200. A.B. Dick makes the hardware, Scott the special film. The system can add images, but not erase, producing output at 25X reduction and storing up to 98 letter-size documents on one 4x6 inch fiche card. Purchase price for the System 2000 is $27,500 plus maintenance.

- Bell and Howell -- which announced an agreement in 1975 with General Electric and Gordon Lysle (Northport, NY) to form Microx Corporation. Lysle contributed the system, GE the film, and Bell and Howell will supply marketing. (One system is currently being used by the Navy.) The film in the B&H system is in a transparent mode, covered with a charged emulsion. Images can be added on demand, data annotated on existing images, and images erased with replacements added in the same position (up to 7 times). The film has no known shelf life or special handling requirements. B&H, which has yet to promulgate prices or production schedules, has exclusive worldwide marketing rights.

- Minnesota Mining and Manufacturing (3M) -- which announced an agreement a year ago to market the Ovshinshky MicrOvonic File (see box, page 7). The 3M/Ovshinsky system will be made in Japan by Ashe Chemical Co.

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THE INDOMITABLE MR. OVSHINSKY'S FICHE AND CHIPS . . .

. . . prefixed "Ovonic," they're amorphous semiconductors, relying on properties other than their crystalline structure to provide their usefulness to electronics. They're the brainchild of Stanford R. Ovshinshky, President of Energy Conversion Devices, one-man fund raising committee, and recent front page attraction in the Wall Street Journal.

While the history of Mr. Ovshinsky and his company -- which is $20 million in the hole -- has been charted in detail in the Journal article (July 7) and in Electronic News (July 11), his inventions are worth a mention. One is a switching semiconductor (the chip) being experimented with by Burroughs, another is a light-sensitive memory device (the fiche) that's the medium in a new updateable microfiche device to which 3M has the marketing rights. That machine is the MicroOvonic File.

Said to be based on a lightweight, desktop camera-processor that plugs into standard electrical outlets, the MicroOvonic file would allow secretaries and librarians to store information on a transaction basis . . . and if IDC sources are right and the file costs between $8,000 and $12,000, it could go a long way toward breaking into the medium- and small-office markets.

What's more, the Ovshinsky devices will get their first tests in the light of day (no pun intended), and much of the controversy surrounding him, his theories, and his envisioned devices should fall away . . . one way or another. Imagine, though, what impact his amorphous semiconductors could have on what industries -- mass storage, word processing, computing, communications, photography -- if they pan out. After all, Mr. Ovshinsky might argue, the human brain doesn't run on crystals, does it?

- Coulter Information Systems -- which has developed a special electrodynamic film currently used by certain Government installations that can achieve continuous tone, very high resolution, and full panchromatic response. Prior to fixing, the film is erasable and reusable almost indefinitely. When archival quality is desired, the images can be fixed on the film. CIS has indicated that the film will be available commercially this year, and outsiders speculate that the company might also develop or adapt a recorder/reader for its use.

- Other companies that are probably experimenting with updateable units, says IDC, are Kodak, IBM, and Xerox.

There are other developments that may affect the COM industry ten years out . . . chiefly other film storage systems with high packing densities, better resolution, faster I/O, and no need for film. Digital Recording Corporation has a video disk unit in prototype, Mansei Kogyo Kabushiki Kaisha has a laser pickup device that will write on film, Holofile Industries has a prototype hologram system which can store 200 megabits per 4x6 inch card and with holofiche containing software (each card can tell how to use the data on it), and Harris Corporation could be ready this year with a second generation of its military Human Readable/Machine Readable (HRMR) hologram mass memory. Other vendors exploring this area are Precision Instruments, RCA, Hitachi, Toray, and Optical Data Systems.

But for now, the COM vendors have other things to think about . . . marketing their new products, adding software to their front-end minis, providing service to their customers, and keeping up with a modicum of growth.

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• IS NOTHING SACRED? NOT EVEN AT&T'S MONOPOLY ON MTS? Perhaps not, ruled a Washington, D.C., U.S. Circuit Court of Appeals this week in reversing the FCC's order that MCI Communications halt its Execunet service. Execunet is a shared private line service for low volume users that involves connections through local Bell exchanges but bypasses AT&T's Long Lines transmission facilities. The FCC had agreed with AT&T that Execunet infringed on its monopoly business and ordered the service discontinued; MCI had been operating under a stay of that order while the circuit court heard the appeal.

The implications of the court decision, if it's upheld up the judicial line, are vast. According to the court, the FCC had not automatically granted AT&T a monopoly in message toll service in its 1971 Specialized Common Carrier decision since that decision was based on inquiries relating only to private line transmission. Said the court: "We are concerned with a thread running through the commission's analysis -- that the specialized common carrier decision granted AT&T a de jure monopoly over MTS and WATS service which would be undermined were MCI allowed to provide Execunet -- because any such assertion is plainly incorrect . . . ."

Although the court decision is a major victory for MCI, which has stated in the past that the demise of Execunet would mean bankruptcy, there may be a loophole for Ma Bell. The court didn't say that it wouldn't be in the public interest for AT&T to be granted a monopoly over MTS and WATS, only that the FCC has never officially granted that monopoly. It could still be done after appropriate deliberation. Meanwhile, however, other alternative carriers must be lustily eyeing that huge dial-up market.

• COPYRIGHT SI, TRADE SECRETS NO said a panel of economists hired by the National Commission on New Technological Uses of Copyrighted Works (CONTU) of the two principle methods of protecting computer programs. Copyrights, said the panel, would encourage disclosure of the programs and enhance the software resources available to users. There would be less progamming duplication, more creativity; trade secrets protection, on the other hand, would inhibit the advancement of the art/science. Author John Hersey, a member of CONTU, had a different view, however, arguing that software programs are not writings since in use they become machines that actually do something (cause switching states in computers). At any rate, whether copyright laws are extended to cover programs or Hersey's proposed Software Protection Act is the proper medium of protection, putting either into effect will take further study, further argument.

• BURROUGHS WINS THE NEWSFRONT TRIPLE CROWN, announcing new computers and memory and gracing EDP/IR's page 8 for the third consecutive time. This time the Motown mainframer has two new 4 MHz B 3800 CPUs, one using 4K memory chips. The B 3834 comes with 100 KB memory expandable to 500 KB and a 16-channel I/O subsystem expandable to 32 channels. The B 3835 has a 500 KB memory expandable to a megabyte (of the 4K chips) and an I/O subsystem expandable to 40 channels. The purchase price for a basic B 3834 with display and console is $231,320 or $5,275/month on a 5-year lease; for the B 3835 it's $317,560 or $7,550/month. The B 3834 is available now, the B 3835 will be available early in 1978.

• AT&T'S TELPAK SERVICE IS STILL ALIVE AND KICKING, following some late night judicial razzle dazzle. An appeals court in New York refused to extend a stay of the FCC's order that Telpak be open for resale and sharing (EDP/IR, June 24, 1977), but later that night a Washington, D.C., appeals court ruled that Telpak could remain alive as it is for existing users. For a while, anyway.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" AUGUST 19, 1977 • VOL.13, NO.3 P.J.McGOVERN,PUBLISHER

Boom in small site printers

SLOW-SPEED PRINTERS TO SHOW CONSISTENT GROWTH THROUGH THE DECADE AS NONIMPACT TECHNOLOGY, SMALL BUSINESS SYSTEM GROWTH TAKES HOLD

For all the glamor of the recent high-speed printer announcements (EDP/IR,June 24, 1977) and the lure of the technology itself -- inkjets, lasers, 45,000 lpm print speeds -- there's plenty of action at the other end of the spectrum. In fact visitors to NCC 1977 might be inclined to say that that's where most of it is these days -- printers abounded in Dallas. It's not remarkable. As the electronics get cheap enough to add function to output devices -- and increase the mechanical portion of system cost -- a shift of attention is natural. What, after all, is a small business system but a printer attached to the electronics to make it work?

Even if that overstates the case, the printer market is in for some healthy growth . . . with the U.S. market for sub-3,000 lpm printers to grow from just over $3 billion installed in 1976 to over $6 billion in 1981. Beyond that growth, some noticeable trends are beginning to take shape:

- The technology at the slower speeds is evolving. Matrix printers are taking over from fully-formed character printers; band technology is invading line printers; nonimpact devices are blossoming.

- Suppliers are maturing, expanding their product lines in speed and function . . . beginning to offer users "one-stop shopping."

- Major OEM accounts are going in-house with printer production, hoping to add to the reliability of their products while trimming costs . . . and meanwhile keeping the OEM market in flux.

- Microprocessors are adding function to output devices, as variable fonts, increased print control, and error detection find their way into the industry's new products.

While the overall printer market will be paced by the growth of high-speed nonimpact devices (IBM 3800 et al) and printers with speeds over 3,000 lpm will grow from 2% of the dollar value of the overall market in 1975 to 15% in 1981 -- the next fastest-growing segment will be in the small end (10-30 cps to 600 lpm). Here, the voracious appetite of small business computer, word processor, and terminal growth will buoy demand, providing an approximate annual growth of 20%.

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DATAPRODUCTS: LINE PRINTER LION

The line printer market may be unique in the computer industry . . . a high growth rate of shipments has not attracted a slew of new suppliers. IBM, of course, holds the overwhelming majority of the general-purpose computer site market; but Dataproducts Corporation dominates the OEM portion remaining with approximately half the dollar market. The company also markets core memories, telecommunications systems, printer components, and ribbons.

Since 1971, Dataproducts line printer shipments have grown at a compound rate of almost 30%, and the company's revenues have grown from $44 million to over $115 million in the same span. Shipments of line printers have grown from 1,200 units in 1971 to 10,500 units last year. Printer revenues have risen fivefold to $86 million.

Over half of Dataproducts' line printers end up in what could be termed "distributed processing" applications -- small business systems and terminals, and some dedicated application minicomputers. Thus, the company has a broad customer base (373 OEM accounts last year) and little dependence on the general-purpose market. The company's recent introduction of a matrix printer -- representing a foray into the lower-speed, lower-cost Centronics' realm -- should expand that base. Still, the company's bread and butter is the line printer market, where its impact and band technology give it strength.

Line printers

The traditional market for line printers with speeds under 3,000 lpm has been the general-purpose computer site, the traditional printers have been the IBM 1403 and 3211. IDC has estimated that IBM commands 70% of the overall line printer market on the strength of its own captive market. Other captive markets are practically nil, in part because of the sizeable investment needed to start up line printer manufacturing and the subsequent lock-in to technology. Thus the establishment of an OEM market . . . dominated by Dataproducts, but participated in by CDC, Dataprinter, Tally, Data 100's Odec subsidiary, and others.

Line printer shipments this year will hit almost 60,000 units, according to IDC forecasts, with 1981 shipments expected to total about 75,000 units (U.S.). By then, OEM revenues could total over a quarter of a billion dollars (excluding militarized printers). As a result, by 1981 predicts IDC, line printers at general-purpose computer sites will number about 130,000 . . . with perhaps a like number in use at small business computer sites. Regarding line printers in general, IDC notes the following trends:

- The higher-speed line printers will see a drop in market share, as medium-sized computer sites lag in growth and high-speed nonimpact printers penetrate the base downward.

- Growth will come, however, from the large base of matrix printer users in the small site and minicomputer base as users fleet up to the faster devices as their output needs increase.

- Impact printers in the 600-1,200 lpm range may soon be vying with nonimpact printers in the burgeoning small computer site market. Small sites will show a 15% growth in total site market share, printers a 12% growth, and original paper output 6%.

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CENTRONICS: MATRIX MOGUL

The idea of dot matrix printing is not new . . . Burroughs and IBM had experimented with it in the 1940s and 50s. The conventional wisdom back then considered matrix printing pretty much a blind alley (IBM used its device to read the holes in punched cards). Then, IBM introduced a matrix printer for use with its System/3 Model 6, and suddenly the concept had legitimacy.

Lo and behold, about that time printer customers discovered that a small New Hampshire company also made matrix printers . . . at an OEM price of about $2,500 no less. It was several years before any competitors appeared on the scene, and by then Centronics Data Corporation's growth had commenced. The firm has shipped over 80,000 printers worldwide; its revenues last year topped $50 million. Future revenue and earnings have been estimated by Wall Street analysts to be in for a doubling by 1980.

Part of Centronics' rosy prospects stem from its "one-stop shopping" concept. Last year the firm expanded its product line downward with the 700 Series of matrix printers; earlier this year it announced an upward extension into line printers with the 6000 Series (75-600 lpm). At NCC the company announced a $600 nonimpact microprinter (240 cps). With a broad range of output devices, Centronics hopes to counter inroads into its traditional hegemony by Dataproducts . . . and the loss of some major OEM accounts to in-house manufacturing.

Character printers

When a line printer offers more performance (and more cost) than necessary, character printers come in . . . traditionally, the lower-speed typewriter-type. By 1981, estimates IDC, the U.S. installed base of character printers will be just over 1 million devices, or about 75% of all printers used with general-purpose computers, minis, terminals, and shared-logic word processors (see EDP/IR, June 8, 1977). On the other hand, they'll account for less than a quarter of those devices by dollar value . . . but still close to $2 billion.

That 1981 installed base, according to IDC estimates, represents an approximate doubling of today's base. At yearend 1976, the number of character printers installed just topped 500,000 units (worth approximately $900 million).

By number of devices, about half of those character printers installed at yearend 1976 were 10-30 cps units; yet over half of their value was accounted for by units operating over 120 cps. By 1981, that very-slow-speed portion (10-30 cps) will drop to about a third in units, a fifth in dollars. Higher-speed printers (over 120 cps) will still account for over half of the dollar value of character printers installed.

Some trends within those growth patterns:

- Matrix printers are becoming the norm for slow-speed printers (one IDC study predicts an annual growth rate over the next four years of 30%, or about 500,000 matrix printers installed in the U.S. by the end of 1981). IBM has endorsed them on its SNA terminals and small business computers . . . as have the minimakers.

- More and more of the big OEM accounts are going to in-house manufacture -- DEC and Wang, for example. (CONTINUED ON PAGE 6)

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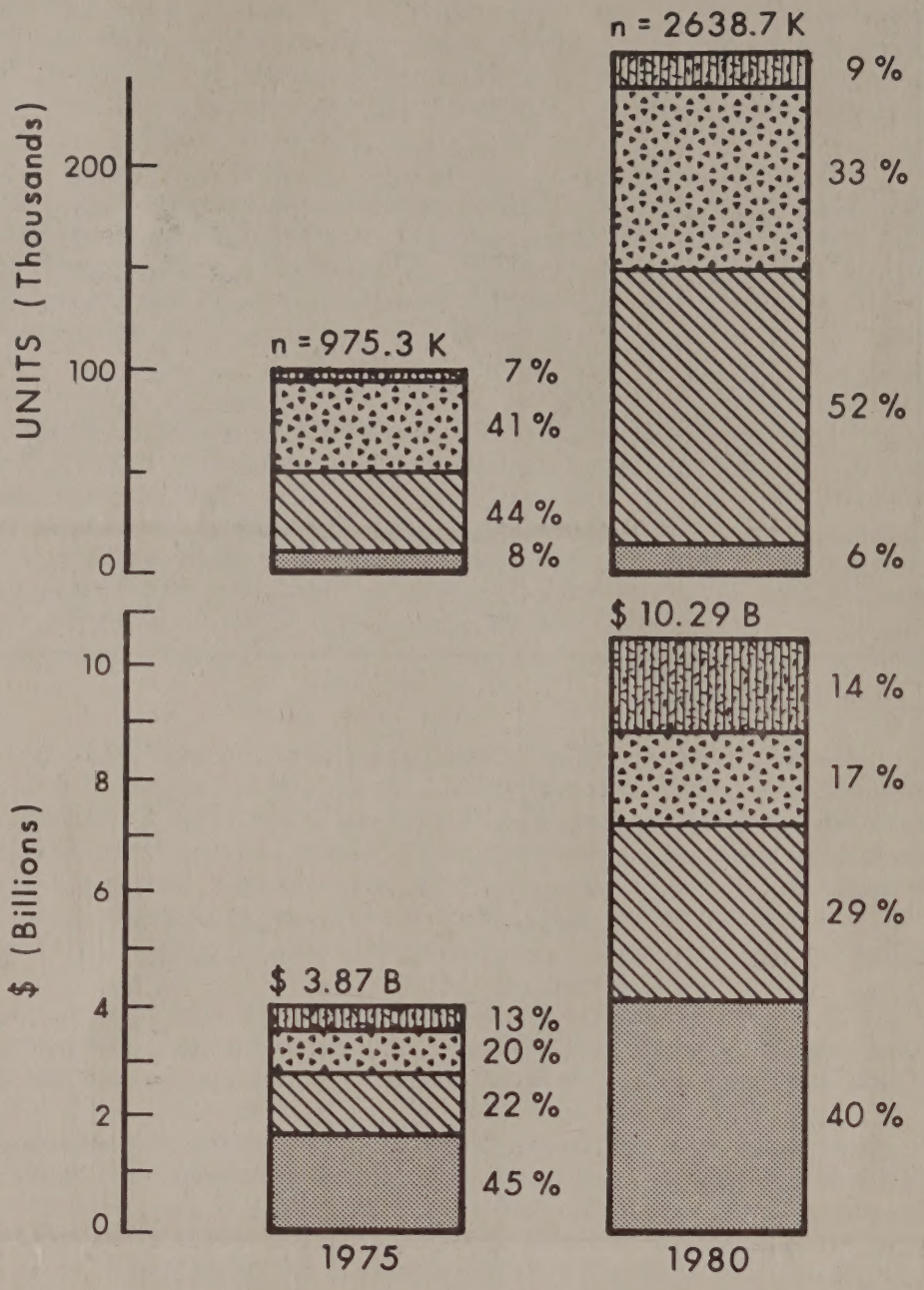
NUMBER AND VALUE OF OUTPUT DEVICES INSTALLED, 1975 AND 1980

Today printers are the most common output devices, and in 1980, says IDC, they'll still take the major cut by units installed.

But note the growth of CRTs as output devices . . . and the fact that in 1980 they'll account for over 50% of all output devices by unit.

In fact, only the composite category of minicomputer printers, word processing printers, and COM recorders will also increase market share.

Still, all categories will show substantial growth . . . and by the end of the decade, the installed base of output devices will have topped the $10 billion mark.



THE MARKETPLACE

EQUIPMENT	OUTPUT
GENERAL PURPOSE COMPUTER PRINTERS	GENERAL PURPOSE COMPUTER FORMS
CRT TERMINALS	NO PERMANENT OUTPUT
TERMINAL PRINTERS	TERMINAL FORMS
MINICOMPUTER PRINTERS	MINICOMPUTER FORMS
WORD PROCESSOR PRINTERS	WORD PROCESSOR FORMS
COM RECORDERS	COM FILM

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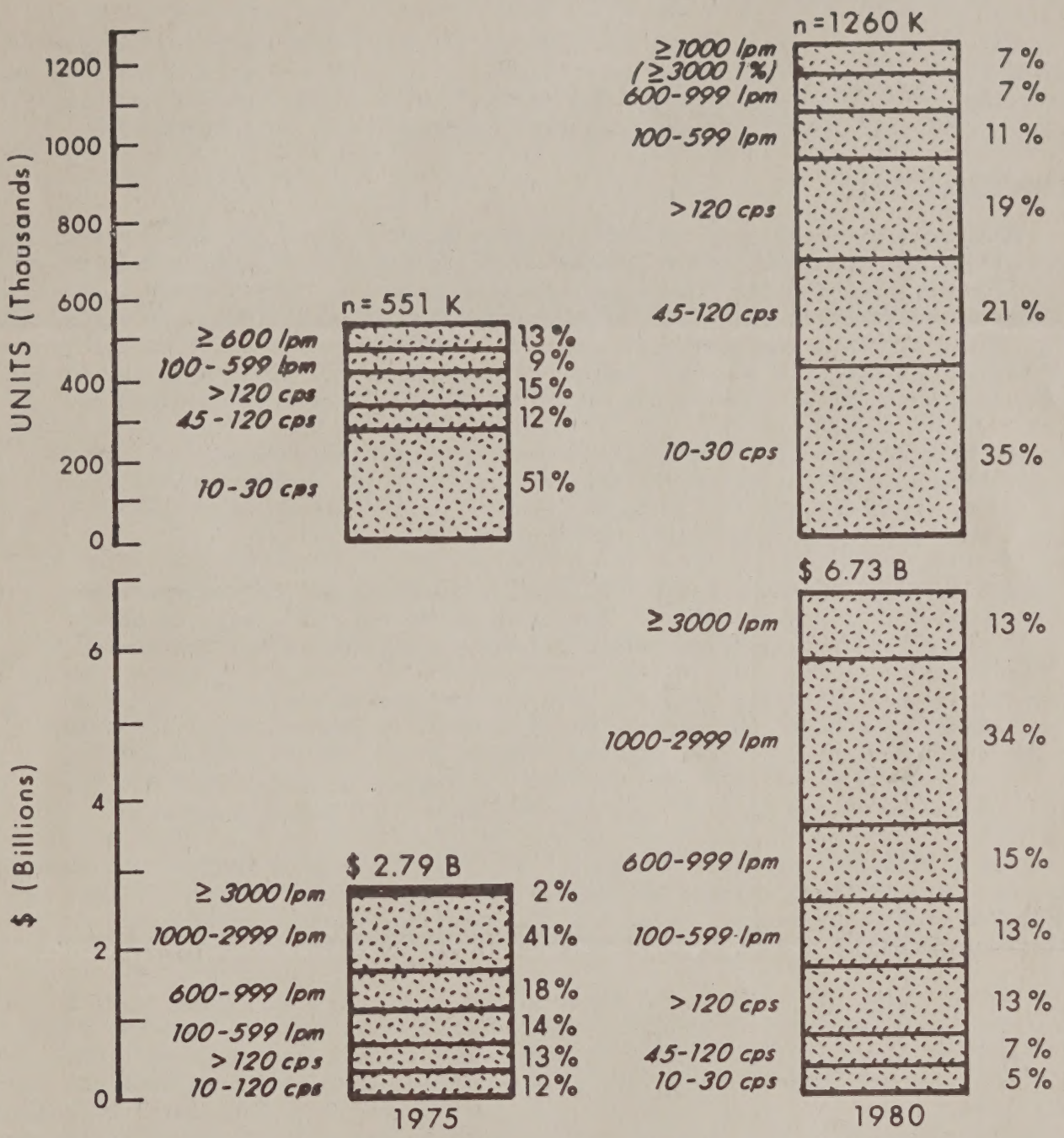
NUMBER AND VALUE OF PRINTERS INSTALLED BY SPEED, 1975 AND 1980



The installed base forecast shown above includes: General-purpose computer printers, terminal printers, minicomputer printers, and word processor printers (only shared-logic/computer-based devices). CRT terminals and COM recorders are excluded.

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- Foreign competitors are getting into the game. Centronics has relationships with Brother Industries and Sharp; Univac is buying Mannesmann dot matrix printers for its BC 7 small business computers, etc.

- Product lines are shifting, expanding. Just as Centronics has entered the line printer market, Dataproducts has invaded the matrix market. So has Teletype, from the other end, with its Model 43.

Nor is all the action in matrix printers. Slower-speed print wheel devices abound (IBM will be using a Qume print wheel in its advanced word processing systems), nonimpact printers are catching on, and IBM even has patents on a hand-held matrix printer that could someday see use in terminals or word processors.

Nonimpact printers

Nonimpact printers comprise two distinct markets. And despite the fanfare surrounding the IBM 3800, Xerox 1200 and 9700, and Honeywell PPS, the first and oldest market has been for slow-speed terminal printers. These printers have traditionally operated at 10-45 cps, most using a thermal technique. Recently, however, there's been a resurgence of interest in slow-speed nonimpact printers since IBM joined the act with the 6640 inkjet printer announced first with the 46/40 Document Processor, later with its Office System 6. Others have joined in:

- Centronics announced a Japanese-developed printer, the Micro-1, at NCC (see page 3) and privately showed a small inkjet printer; Dataproducts has announced the T-80 Thermal Printer, which uses an Olivetti print head and can cost under $1,000/unit in OEM quantities.

- Siemens has announced its PT80 Ink Jet Terminal as the nonimpact version of its PT80 terminal. Operating at 90 cps, it's said to be the first inkjet teleprinter since Teletype's off-the-market InkTronic.

- Other new nonimpact printers have hit the market recently: Axiom's EX-800, an 80-column printer weighing only 12 pounds, Telpar's PS-40, a small thermal printer reputedly based on a Canon (Japan) mechanism, Computer Devices' 1204 and 1205 30 cps thermal printers, and SCI Systems' 2,200 cps (4-inch wide paper) Series 1100 Rotary Printer.

Older printers have been available from NCR, Texas Instruments, and Computer Devices. New devices, though, are likely to come not only from the current vendors, but from other sources as well . . . Canon and Okidata from Japan, for instance, perhaps the computer mainframers here in the States.

At any rate, IDC expects the forecast for slow-speed nonimpact printers to show considerable growth. From less than 1% each of the general-purpose computer and terminal printer markets, by 1980 nonimpact printers are expected to grow to 4% of the general-purpose market, 3% of just the editing and conversational terminal market. In the early 1980s they should also begin to penetrate the remote-batch and intelligent terminal markets, as well as the small business system market. Inkjet printers will pentrate the primarily thermal terminal nonimpact market, electrostatic printers will dip down into the small business computer and intelligent terminal realm.

For now, however, the action in the slower-speed printer market appears to be occurring on three fronts:

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+ Matrix printers are proliferating, lead by IBM and Centronics offerings, but followed by those from a slew of manufacturers.

+ Lower-priced line printers, with increased function provided by LSI technology, are offering matrix users new upgrades; output at small computer and mini/small business system sites is propping demand.

+ New technologies are massing for an attack on traditional markets, particularly nonimpact printing technology.

In addition, as with much in the data processing world these days, printer markets are becoming increasingly exposed to foreign-made devices, especially those from Japan. And, of course, much of the future growth will revolve around IBM's actions in the market.

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USER SURVEY MARKS IBM'S NEW 3270s AS UPGRADE TOOLS,
USERS CITE IBM REACTION TO COMPETITION AS REASON FOR ANNOUNCEMENT

In a survey of 50 users of IBM 3270-type terminals -- still in the works at IDC with preliminary results published in Distributed Processing Newsletter -- it was found that users generally consider the Giant's recent 3270 announcement (EDP/IR, June 8,1977) as a reaction to inroads made by competitors. Ironically, the reactions of users to the move foreshadow little devastation of the PCM market . . . for the most part, the new gear will replace old IBM 3270s.

A summary of the findings:

- Users were surprisingly well-informed about the price changes -- only one wasn't aware of the price changes and hadn't made appropriate plans.

- The 3278's price performance was its biggest selling point . . . many users saw little real functional advantage, including the large screen.

- Sites planning to add only old 3270 equipment were generally either locked in through equipment acquisiton method or existing applications . . . or had independent gear with which they were satisfied.

- Of the sites not planning to add either new or old 3270s to their configurations, most had either financial constraints or had independent gear and were satisfied with the present configuration.

- Of the sites indicating how their replacement activity would take place, half said would replace all of their 3277s with 3278s.

Out of the fifty users contacted, almost half said they would be adding the new 3270s when they became available, a third said they were planning to add only the older models, and a fifth said they didn't plan to add anything in the near future. Few users expected to change acquisition method, and IBM's new lease plan received little mention . . . perhaps because of little user awareness, perhaps because of the nature of the survey.

Even if the new 3270s turn out to be primarily upgrade machines and 3270 PCM suppliers won't be immediately affected, the new units may still prevent further penetration of the IBM base (30% as of 12/76) . . . at any rate they have initiated a new price/performance curve for the ubiquitous terminals.

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• ITEL UND SIEMENS WERDEN ZUSAMMEN EINEN NEUEN DRUCKERTYP HERVORBRINGEN . . . which is another way of saying that Itel and Siemens have announced joint venture plans for the development of an IBM-compatible laser printer. The initial Itel system will utilize Siemens' new ND-2 printer (EDP/IR,June 24,1977). Itel plans to mold the OEM device into something plug-to-plug compatible with the IBM 3800 and expects to have a system ready for benchmarks and tests by yearend.

• AN APPROPRIATE NOTE ON DEC'S PLATINUM (MODERN) ANNIVERSARY: "Congratulations on twenty years of business and on your recent revenue milestone." The Maynard minimaker, founded in August, 1957, reported revenues this month for its latest fiscal year of $1.06 billion, earnings of $108 million. Sales and earnings were up 44% and 48% respectively over last year. Just two years ago the company topped $500 million in sales for the first time.

• AETNA HAS FINALLY TURNED ON ITS SBS FAUCET, starting with an initial amount of $1 million. The user third of the Satellite Business Systems troika had heretofore only coughed up $1,000, as competitors had occasionally been eager to point out. Under the original SBS agreement, each of the three parent firms (IBM, COMSAT, Aetna) vowed to share equally the $165 million startup investment . . . but Aetna had withheld its backing until it was determined that the FCC's order authorizing SBS's domsat plan was satisfactory.

Separately, SBS has announced that it will conduct an advanced communications experiment, codenamed Project Prelude, in association with Comsat Labs and other companies. Project Prelude will use NASA's Communications Technology Satellite (CTS), launched last year and operated in conjunction with the Canadian Government, to test the 12/14 gigahertz band for high-speed data, video, and facsimile transmission. Various companies will supply the equipment used in the experiment, including two small "transportable" earth stations from Comsat Labs. The user tests will take place at the headquarters of three companies: Rockwell International, Texaco, and Montgomery Ward.

• BUT WILL THE PACKETS WANT TO COME BACK ONCE THEY'RE THERE? . . . Telenet has filed with the FCC to extend its packet-switched network services to Hawaii. The proposed service will be operated in cooperation with the Hawaiian Telephone Company and be available on a demand basis with rates based on the volume of data exchanged. The CCITT X.25 packet mode interface will be supported; traffic charges will be $4.00/thousand packets, $2.40 an hour for public dial-in service at 10-30 cps in Honolulu-to-the-U.S. transmissions. Telenet hopes to begin service in the fall, with service in other Hawaiian cities beginning next year.

• WATCH FOR A CHRISTMAS CRUNCH ON PERSONAL COMPUTERS, says Pertec, relatively new owner of MTS, one of the pioneers in personal computers with its Altair system. Pertec points out that it currently sells through more than 50 computer stores and 30 retail outlets . . . but has requests for 800 store locations. Just stocking the new stores will tax personal computer production; further, the spate of recent national press attention may spur the market beyond supplier capacities. Thus watch for shortages over the next few months.

• A SUBTLE SHIFT IN R&D EMPHASIS? IBM has announced the establishment of a "General Technology Division" to come under its General Business Group (OPD, GSD, etc.). The division, to be responsible for semiconductor R&D, will include two plants formerly under Systems Products Division in the DP Group. The move seems to throw some more R&D weight onto the smaller systems end of IBM's line.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" AUGUST 29, 1977 • VOL.13,NO.4 P.J.McGOVERN,PUBLISHER

APPELATE COURT RULES GREYHOUND SHOULD HAVE ITS DAY IN COURT
REVERSAL OF ANTITRUST SUIT DISMISSAL HEARTENS OTHER IBM LITIGANTS

. . . it is still the law that size alone does not constitute an offense under the Sherman Act, nor does the mere possession of monopoly power. It is the wrongful use and exercise of that power which is proscribed by Section II of the Act.

Assuming (IBM) does hold a substantial share of the market, whatever that market may be, it is the opinion of this Court from the evidence adduced thus far on the record that (IBM's) place in the industry has been achieved as a result of superior skill, foresight, and industry.

The Court is of the opinion that (IBM's lease and purchase pricing activity) was brought about by economic factors over which (it) had no control . . . that there is no evidence of an attempt to monopolize, in the record.

Were the jury to consider this record in its present state, it would be purely speculative as to how (to determine damages).

-- Judge Walter E. Craig, dismissing Greyhound, EDP/IR, 7/13/72

It had been so long since the last had been heard on the Greyhound appeal -- argued on appeal on April 10, 1974 -- that observers began wondering if it hadn't just been swallowed up by the system, never to be heard of again.

But for Greyhound Computer Corporation -- which saw its hopes for immediate redress on antitrust claims filed in late 1970 dashed over four years ago when its suit was dismissed without IBM ever presenting its case -- the long delay may have been beneficial. The appellate judges, it seems, went over the leasing company's arguments and evidence with a fine tooth comb. In the years since the oral arguments before the Ninth Circuit Court of Appeals, Judges Browning, Moore, and Wallace reviewed the transcripts of the 24-day Phoenix proceedings and deduced:

The standard in review of a directed verdict favors Greyhound. We are "bound to view the evidence in the light most favorable to (Greyhound) and to give it the benefit of all the inferences which the evidence fairly supports, even though contrary inference might be drawn. . . . We affirm the directed verdict on the contract issue, but reverse and remand for trial the monopolization and attempt to monopolize claims.

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SUBSTANCE OF THE DISMISSED GREYHOUND COMPLAINT

IBM exercised its substantial powers in the general-purpose computer and leasing industries to exclude leasing companies as competitors, exercising monopoly power and displaying an attempt to monopolize, with practices not limited to:

+ pricing equipment at unreasonably high levels in relation to rental prices (raising purchase-to-rent multipliers from 42 to 48)
+ pricing new equipment at original price levels regardless of obsolescence; cessation of "Technological Discounts," used by leasing firms
+ abolition of free support and software for which Greyhound had paid a bundled price at the time of purchase
+ reduction of IBM lease rates (FTP,ETP) after sale of more than $150 million of equipment to Greyhound
+ increase in maintenance by 50% to purchasers, not to rental users
+ breach of contract regarding services to Greyhound leasing customers*

* Dismissal upheld by Ninth Circuit Court of Appeals

Furthermore, the appellate court did more than simply remand the case in part for retrial. It spelled out the reasons why. In a way, the Court -- which will be the appellate bench in the West Coast cases coming up and in the CalComp appeal, as well as in any future Greyhound appeal -- exposed some of its legalistic thinking. One of the judges (Moore) disagreed with this approach:

> *In my opinion any comments on the effect of such evidence as may be developed therein is premature and inadvisable. All that is before us is the evidence offered by plaintiff. Ultimately the case will go to the jury on all the evidence (offered by both sides).*
>
> *Until we know the jury's answer, we should not, even in an anticipatory or declaratory way . . . make any pronouncement on a record yet unmade.*

With a retrial possible, Greyhound gets a chance to refine its case -- perhaps retooling strategy in light of IBM defenses in other cases -- and stress its points along the lines suggested in the appellate court's decision.

Perhaps even more important, the decision creates a favorable climate for an out-of-court settlement. Greyhound has been out of the leasing of new equipment since the advent of the 370 -- ironically, this is a major point of the trial, and yet also a reason to settle. And IBM stands to lose time, money, and legal momentum if the case is allowed to begin its long trek back up the legal ladder.

At any rate, EDP/IR sees a certain amount of fallout from the ruling:

- The Court's interpretation that relevant markets can be construed along fairly tight lines bodes well for other litigants going against IBM.
- IBM's contention that the "youth, change, and growth" of the industry -- a key defense in all its antitrust suits -- has been challenged.
- The relevant market and predatory tactic interpretations of the Ninth Circuit Court (admittedly in a pro-plaintiff construction) differ markedly from the Tenth Circuit's . . . offering hope that the matter will ultimately be decided by the Supreme Court (within our lifetimes).

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BLUEPRINT FOR A RETRIAL?

One of the more significant aspects of the Ninth Circuit Court decision was its presentation. In a 39-page filing the Court outlined in detail where it felt Greyhound had produced sufficient evidence to go before a jury. Despite all of the qualifications expressed, the opinions seem to give a preview of Appelate Court reasoning . . . just the fact that any reasons were given at all is significant. The basics of the decision are outlined below:

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I. Factual Background and Standard of Review -- the Court's view of the industry and computer leasing, and recount of district court's verdict.

II. Monopolization -- supported under the Sherman Act by two main elements: monopoly power in a relevant market (A&B) and willful exercise (C) of it.

A. Relevant Market -- enough evidence was offered for a jury to conclude that the submarkets are distinct, not only for general-purpose computers, but for their leasing, as well (although "it is a closer question"). It's not necessary to decide if IBM's product line is a separate market; the above finding is sufficient to go to a jury.

B. Possession of Monopoly Power -- sufficient evidence on IBM market share and price control was presented. "Youth, change, and growth" do not immunize an industry from monopolization; there was evidence of substantial barriers to entry and exit from the market.

C. Willful Acquisition and Maintenance of Monopoly Power -- Greyhound's complaint is that IBM undertook to advance its own leasing operation at the expense of the leasing companies by making computer purchase unattractive. If a jury concluded IBM did employ monopoly power, normally legal acts that excluded competition would be unlawful:

1. Fixed Term Plan -- Greyhound failed to show IBM's action was more than simple response to competition.
2. Technological Discount -- there was evidence that the consequences on leasing companies of IBM's actions were intended.
3. Multipliers and Maintenance Rates -- Greyhound's multiplier calculations can be supported; moreover, IBM's multiplier increases can be shown counter to the economic model.
4. Unbundling of Service -- perhaps it was procompetitive to unbundle, but it was anticompetitive to leave the leasing companies with inflated investments and lowered returns.
5. General Defenses
   a. IBM argues its marketplace power is based on business acuity, but evidence can support that the company maintained it with exclusionary tactics.
   b. Even if Greyhound didn't prove IBM had a monopoly in general-purpose computer sales, IBM could still violate the act using sales tactics to affect leasing.

III. Attempt to Monopolize -- If Greyhound did't offer sufficient proof on all counts objected to by IBM (there were four), it did on at least one.

IV. & V. Evidentiary Rulings and Breach of Contract -- the district court judge was upheld.

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- The question of redress years after the offense is a growing concern to IBM antitrust litigants. The outcome of the ruling will be interesting to watch in this regard.

In addition, the Greyhound decision adds hope to the other West Coast litigants -- Hudson General, Transamerica, Memorex, and Forro -- since appeals for their cases will land in the Ninth Circuit. The decision gives them leverage in working out-of-court settlements . . . and EDP/IR wouldn't be surprised to find IBM amenable to such solutions.

(CalComp, which saw a directed verdict levied in its case last winter, also falls in the Ninth Circuit. Maxwell Blecher, CalComp's attorney, has predicted that if the Court remains consistent in its reasoning, his client will get a retrial; a brief requesting such was submitted last week. CalComp is especially heartened over the matter of relevant market.)

Meanwhile, the industry is once again in that curious state of legal flux . . . which has litigants dusting off their options, negotiators polishing their bargaining chips, and observers watching the clock.

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FORRO PRECISION BEGINS ITS CASE AGAINST IBM BEFORE JUDGE McNICHOLS STRESSES IBM INFILTRATION AND MISUSE OF CONFIDENTIAL INFORMATION

While Greyhound Computer Corporation was getting the nod for another chance at flinging its antitrust arrows at IBM, tiny Forro Precision, a privately-held components manufacturer, was getting in its first volley. Filed in August, 1974, the company's antitrust case went to trial on August 15 before U.S. District Court Judge Ray McNichols (of CalComp fame) and a six-person jury. If the Forro case goes the route -- and dismissal may be less likely now in view of the Ninth Circuit Court of Appeals decision regarding Greyhound -- it will be the first antitrust trial against IBM to be decided by a jury.

Forro asks for $36 million ($12 million trebled for damages), alleging that IBM has monopolized the EDP industry since 1954, has competed unfairly with Forro in the manufacture of computer components (disk drives), and has utilized monopolistic and predatory practices . . . including introduction of the 2319A&B disk drives, FTP and ETP leases, and the Winchester disk drive. It's the standard peripherals company antitrust fare.

What's not so standard is Forro's allegation that IBM interrogated employees, seized business records, and otherwise threatened or coerced Forro with the intent of destroying its business . . . such actions taking place as part of IBM's investigation into alleged trade secrets thefts. IBM, says Forro, hired a former FBI investigator in 1970 to ferret out "what Forro had, find out what their production was, find out who their customers were, prices, things like that" . . . information IBM couldn't get from the marketplace. Forro further alleges that IBM leaked a deposition taken in the IBM-Memorex case from Forro's owner, Robert Fowler. Some of that information, says Forro, went to its customers.

IBM counters, denying Forro's charges and raising the issues of "unlawful market presence" that Forro's theft of trade secrets gave it and "defense and recoupments" . . . based on the theory that Forro acquired illegal profits from the sale of its products and they should offset any antitrust liability of IBM's toward Forro. As a result of the perceived thefts, IBM initiated a $25 million countersuit in September, 1974. Since then the two suits have been consolidated.

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As for its actions of "infiltration," IBM says they were natural events arising out of a joint effort between the Santa Clara District Attorney's Office and the San Jose Police Department in investigating the theft of IBM trade secrets. IBM, said its attorney, Henry C. Thumann, last week, began suspecting the theft of 3330 technology in the fall of 1970, Winchester technology in 1972 . . . with evidence tracing some of the traffickers to Forro's door. And besides, he argued, IBM didn't damage Forro at all . . . it was the illegal exploitation of IBM development that led to Forro profits.

The next antitrust trial scheduled against IBM is Memorex's, with a tentative starting date of January, 1978.

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THE DEPARTMENT OF JUSTICE EDGES CLOSER TO A CONCLUSION IN THE IBM CASE AS PERIPHERALS WITNESSES, ECONOMIST, AND CONSULTANT TESTIFY

Once, as recent as the last time EDP/IR reviewed the status of the IBM-U.S. trial (Feb.28,1977), it was thought that the DOJ side of the massive suit would be completed by Labor Day. Not quite. In fact, while government spokesmen talk of the first half of the case ending in late October, EDP/IR, considering past deadline slippage, thinks New Year's is more like it.

At any rate, the case is continuing. Witnesses for AMS (Intersil), Memorex, and CDC testified that IBM actions in bundling, maintenance policy, and product introduction affected their companies adversely; a government economist testified that divestiture was the only remedy for dealing IBM's monopoly power; and an Arthur D. Little consultant who had resisted testifying for over a year gave his numbers on IBM's market share.

In addition, the Judge continued to harrangue attorneys for their lack of alacrity, several bomb threats forced evacuation of the court building, and a summer recess began on August 18. Court will resume on September 12.

The peripherals case

The peripherals portion of the DOJ's case, begun last fall at the same time that CalComp went before Judge McNichols, follows the standard script:

+ IBM's FTP and 2319 disk introduction affected peripheral makers' abilities to raise capital, memory bundled into the mainframe and IBM maintenance policies affected the add-on market.

+ Purchase prices and maintenance policies made the leasing of 370s and some of the new peripherals by third parties untenable.

+ Preannouncement of IBM gear thwarted independent customer presentations.

To counter, IBM attorneys hammered at the witnesses with the point that many of the independents, especially Memorex, had management problems and marketing hassles of their own making . . . it was these, IBM argues, that brought about their travails. (One interesting counter to this argument came from a CDC witness who stated that his company got into the peripherals business when it determined that IBM would drive the others out . . . leaving a hole for CDC).

Another counter to IBM's rebuttal came from the Giant's own files in the form of a memorandum that IBM had considered "privileged" -- the Giant fought to keep

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THE PERILS OF TESTIMONY

While it's easy enough to think of the U.S.-IBM trial as something taking place on another planet (one with much more gravity, slower revolutions), it does have its moments of real world impingement. Witnesses find themselves isolated from family and job; lawyers discover a drought of vacation days.

One of the more bizarre cases of real-world fallout occurred when Gordon Brown, Senior VP for Marketing and Planning at CDC, took the stand. On June 8, Brown testified that CDC had lost a disk drive contract with a French company named Sollac because IBM preannounced an enhanced 3350 this May. On June 9, he reported that as a result of his testimony the day before some IBM executives had visited Sollac and complained that the preannouncement had been confidential. Brown hinted that the DP manager's job was on the line.

On June 29, Brown completed his testimony and wrapped up the tale. Sollac had demanded a letter of apology from CDC because it felt that Brown's testimony had placed it in an unfavorable spotlight. A letter had been sent.

That wasn't all. At the time of the original testimony, CDC had been bidding on a contract at Sollac and Brown had predicted a loss of business . . . "I'll be wearing a black hat, after this." As he predicted, Sollac let the contract to Itel, and CDC's business went thataway.

it out of the case for two years -- that indicated IBM knew actions it was taking could be viewed as anticompetitive. According to the memo, files on certain matters were to be kept "clean" . . . "If the (370/155) announcement is in any way accelerated, it is vitally important that no anticompetitive motive be spread in the files." One government witness hypothesized that the memo explained the lack of information on Memorex's computer system in IBM's files. (IBM had conducted extensive studies on Memorox's PCM peripherals strength; in the late 1960s the company was experimenting with its ill-fated MRX/40 and 50.)

An economist and a consultant

Two of the more intersting witnesses in these twilight days of the DOJ presentation have been Dr. Alan K. McAdams, a government economist, and Frederick K. Withington, a consultant and computer industry expert from Arthur D. Little.

McAdams' testimony was significant because of its summary nature. The former Cornell professor has been following the case since it began and was presented by the DOJ to help underline its case. Much of his testimony related to documents and testimony presented already. His findings:

- Yes, IBM is a monopoly, in both general-purpose computers and the various submarkets, with the proof hinging on provable intent. The only cure for monopoly power in IBM's case is divestiture . . . regulation would be ineffective.

- IBM's intent can be shown by its actions in "fighting machines," early announcements, lease pricing, and "top down" announcements that prevent users migrating from old systems to newer -- but smaller -- ones.

- There are separate and distinct submarkets for general-purpose computers, tape drives, disks, and add-on memories.

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- Two types of barrier to entry and exit have been erected by IBM . . . passive barriers like the rental nature of the business and active ones like the 360/44 "fighting machine." Plug-compatibility is both.

While all these points have been enumerated already in the DOJ's pretrial brief and its arguments to date, McAdams' strength so far has been his tieing together the evidence entered into the record. Observers and participants at the trial have often criticized the government for its shotgun approach to entering evidence . . . McAdams seems to be culling out the DOJ's case for Judge Edelstein. Even if IBM's experts come to opposite conclusions, testimony and documents will have at least been weighted for the Judge's consideration.

Withington's significance stems from the fact that he testified at all. For over a year he resisted subpoenas, claiming unnecessary burden. When he did speak, it was to defend his market share analysis of the computer industry (IBM: 65%-71%) and relate industry trends. His numbers essentially supported the DOJ's, his breakdown of the industry paralleled McAdams' view. IBM's biggest competitor in the $46.5 billion (Withington's numbers) industry are Univac, HIS, and Burroughs with 7.1% each. The only other competitors are CDC (3.6%), NCR (2.6%), and DEC (4.1%). Six others have left the market since 1961.

Atmosphere of tension

As usual, the case is being made within the confines of the evidence and tesimony, but outside happenings are drawing attention:

- The lawyer lineup is changing. Raymond Carlson, lead DOJ attorney, will probably retire when the DOJ's case is finished, to be replaced by Robert Staal, a relative newcomer to this case. David Boies, one of IBM's barristers, will leave shortly to become counsel, ironically, for the Senate Antitrust Committee. New lawyers have been taking their turns before Judge Edelstein . . . sometimes with a deterioration in the speed and pointedness of questioning.

- Edelstein's irascibility with regard to the lawyers' sense of urgency is as strong as ever, even if it doesn't seem to have much effect. As of late, though, he's been especially hard on IBMers, and there is speculation that this might affect the record. Relations between the lawyers for both sides is strained at best, almost brawling at worst.

- Edelstein's willingness to hear testimony on current events (Amdahl, 370 memory price changes, etc.) may be significant. Perhaps the trial is not to be a million dollar flogging for a long-dead horse.

- The pace of the trial is still its most prominent characteristic. IBM's cross-examinations have been especially slowing, often lasting twice as long as the DOJ's direct.

In the antitrust arena as a whole, the specific arguments against IBM's power -- monopoly or not -- seem to be picking up a finer edge. Points made by the Ninth Circuit Court bear a striking resemblance to some made by the DOJ's witness, McAdams. Relevant market and predatory tactics issues are being recited almost by rote. IBM's brush fires are all part of the same smoldering issue. But if there appears to be a coherence between the disparate arguments . . . perhaps it's only because everyone's getting so much practice at this antitrust business.

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• THERE'S MORE ACTION IN THAT AUSTRALIAN TRADE PRACTICES FLAP, reported in EDP/IR on July 29, 1977. The Australian Minister for Business and Consumer affairs has proposed some changes to the law limiting manufacturers' liabilities in the event of equipment failure. IBM and the other major mainframers, claiming the current Trade Practices Act, amended July 1, exposes them to open-ended liability for direct and consequential damages resulting from their malfunctioning equipment, had ceased signing contracts. (But not ceased selling!) The computer makers are still not signing contracts, but the Minister's proposals offer hope that the matter can be cleared up to the satisfaction of the companies. The net effect of the proposed changes would be to take away from business customers the right to sue for "consequential" damages such as the loss of data or privacy resulting from downed equipment.

• NCR HAS SOME NEW DATA ENTRY TERMINALS, introduced by its subsidiary, Data Pathing, Inc. The MIT (Modular Intelligent Terminal) 134 Display Station and 102 Attendance Terminal are compatible with other devices from the factory data entry company. The MIT 134 Dispay Station features four screen-size formats and is designed for use in offices. It complements the MIT 133, primarily a factory system, and costs $2,800. The 102, with one model that reads Hollerith-coded employee badges, one that reads "2 of 5" coded badges, costs $1,900.

• COMING OUT FROM UNDER THE PALL OF DATRAN: Wyly Corporation's recapitalizaton plan -- the result of Datran's bankruptcy last year -- has been approved by its board of directors. Trading in Wyly common stock and 7 and 1/4% debentures had been suspended as of August 2, pending the announcement. Said Sam Wyly, the company's chairman, "Under the previous plan approximately $85 million of the $105 million total debt was tendered for exchange. While this represented good progress toward our recapitalization, it was simply not enough to solve the company's problems. The revised plan is to answer many of the objections raised by debenture holders during the past several months. It is the best and last offer the company will make on a voluntary basis." This was the second recapitalization plan from the company, which reported a loss for the six months ended June 30 of $1.8 million. First half results last year showed a loss of $67.8 million.

• MEMOREX WAS APPROVED FOR RELISTING ON THE BIG BOARD THIS WEEK, with trading to resume September 7. The company, one of the major antitrust antagonists of IBM, was delisted in 1973. This is the first such relisting since 1964.

• TI HAS A NEW DESKTOP OFFICE PRINTER CALCULATOR, the TI-5220, designed to process large, heavy volumes of such business calculations as invoices, payrolls, financial statements, and budgets. The system features a four-key memory, independent add register, grand total register, various function keys, and a thermal printer. Prices were unavailable from TI since they will be set by dealers.

• COMTEN HAS UPGRADED ITS LINE OF COMMUNICATIONS FRONT-ENDS with the announcement of the 3690 Communications Processor. The 3690, a follow-on product to the company's 3650 and 3670 replacements for IBM 270X and 370X controllers, can handle up to 512 full-duplex channels through 32 modem interfaces, giving the user an aggregate 15.4 MB/second channel throughput for both storage banks within the processor. The 3690 can support up to eight IBM hosts and provide support for both IBM and non-IBM terminals. The system can also be used as an advanced network processor, operating under Comten's Data Switching System (DSS). DSS is a group of licensed program products compatible with and said to extend IBM's SNA.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" SEPTEMBER 6, 1977 • VOL.13,NO.5 P.J.McGOVERN,PUBLISHER

International review

U.S. COMPUTER MANUFACTURERS CONTINUE TO DOMINATE OVERSEAS EDP AS EUROPEAN MARKET MATURES, JAPAN LOOKS EASTWARD, THIRD-WORLD MARKETS EMERGE

With the decade winding to a close, U.S. computer merchants are increasingly casting acquisitive eyes toward foreign markets in order to sustain their booming production lines. IBM's 1975 overseas revenues surpassed its domestic intake for the first time (EDP/IR,Feb.13,1976); in 1976, overseas shipments by U.S. general-purpose computer makers outdistanced domestic shipments -- another first (EDP/IR, April 22,1977). And now, according to a recent worldwide computer industry analysis by International Data Corp. (publisher of EDP/IR), the overseas installed base of general-purpose computers has finally topped that of the U.S.

Nonetheless, U.S. manufacturers continue to dominate the overseas market with over two-thirds of the installed base by value. On a worldwide scale, the U.S. mainframers garner almost a 7/8ths share . . . reflecting the meager U.S. market penetration by foreign suppliers. However:

- Non-U.S. makers are currently experimenting with ways to impact the U.S. market. Most widely publicized are the joint ventures between Japanese and American firms, but West German companies such as Nixdorf (purchaser of Entrex) and Siemens (marketing linkup with Itel) have also found openings. Additionally, foreign makers are establishing U.S. beachheads through subsidiaries -- e.g., ICL, Nixdorf, NEC, Matsushita. These firms are still learning the complexities of the fragmented, highly competitive U.S. market, but hungry U.S. partners are quite willing to do their bidding (and selling).

- Exports are becoming increasingly important. The Japanese, with heavy investments in future technology, and an economy based on labor- and technology-intensive industries, must distribute R&D expenditures across a wider base than their domestic markets can handle. The Europeans however, seem to be taking a different, perhaps unhealthy approach . . . they are concentrating more on limiting imports than on augmenting exports.

- Maturation of the European and Japanese markets is engendering a scramble to penetrate third-world and communist bloc markets, most of which are still in their EDP infancy -- with excellent potential.

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ESTIMATED WORLDWIDE INSTALLATIONS OF GENERAL-PURPOSE (ONLY) COMPUTERS YEAREND 1976
COMPUTERS IN USE: GNP AND POPULATION
(Copyright 1977 by International Data Corporation)

Country	Pop. (1976-Mil.)	$ Bil. GNP (1976)	# CPUs 1976	$ Mil. CPU Val.	% Total	# CPU/ Mil. Pop.	$ Val. CPU/ GNP
U.S.	215	1,691	61,126	37,287	45.3%	284	2.2
Japan	112	550	19,319	8,331	10.0%	172	1.5
Canada	23	92	3,372	2,301	2.7%	145	1.2
West Germany	62	452	10,660	6,527	7.9%	173	1.4
United Kingdom	56	217	8,543	4,794	5.8%	153	2.2
France	53	346	9,186	4,768	5.8%	173	1.4
Italy	56	163	4,491	2,119	2.6%	80	1.3
Belgium/Neth.	24	155	3,575	1,988	2.4%	152	1.3
Scandinavia	22	170	2,744	1,869	2.3%	124	1.1
Switzerland	6	60	1,723	1,144	1.4%	271	1.9
Spain	36	103	1,613	800	1.0%	45	0.8
Other W. Europe	30	92	1,198	656	0.8%	39	0.7
Sub. W. Europe	345	1,758	43,733	24,665	30.0%	127	1.4
South America	309*	301**	3,237	1,396	1.7%	10*	0.5**
Africa - Mid East	516*	322**	1,837	901	1.1%	4*	0.3**
SE Asia - Oceania	1,114*	250**	1,549	729	0.9%	1*	0.3**
Australia	14	92	1,874	985	1.2%	137	1.1
USSR	255*	787**	11,482	3,979	4.8%	45*	0.5*
Other E. Bloc	127*	326**	3,817	1,515	1.8%	30*	0.5**
Sub E. Bloc	382*	1,113**	15,299	5,494	6.7%	40*	0.5**
TOTAL	3,030	6,169	151,346	82,189		50	1.3

* Mid-1975 Population; ** 1975 GNP

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- Foreign markets are moving into a second growth stage. Packet-switching networks, spurred by the establishment of international standards, are linking data, EDP service bureaus are offering computer time, and leasing companies are rapidly joining the ranks of multinational businesses.

Still, the EDP world reflects "have" and "have-not" nations. Only thirteen countries have more than 100 general-purpose computers per million people, and only three of these have an installed base worth over 2% of their GNP. In fact, while countries in Africa, South America, the Mideast, Southeast Asia, and Oceania have a major share of the free world population, they have only 5% of the computers installed -- altogether about the same base as West Germany. There are however, some up-and-coming markets among the "have-nots," including:

+ Brazil, the largest South American country, has over ten computers per million people . . . and over 1200 systems (worth over $500 million) installed. Small computers and minis (see EDP/IR,Aug.9,1976) are even more in vogue. Politics and inflation often interfere with the growth of the country's markets.

+ South Africa, with almost $500 million worth of computers installed, has 32 general-purpose computers per million people, and boasts an installed value that is 1.4% of its GNP. Although there is great potential, marketing difficulties (due to its peculiar political situation) are hampering growth.

+ The Mideast, still computer-poor, has tremendous potential. Israel holds almost 40% (by value) of the area's computers, but the oil-rich Arab nations have embarked on a development path that should spur computer acquisitions. An example is Saudi Arabia's multi-billion dollar upgrade of its telecommunications system, including the addition of 470,000 telephone lines, and a $400 million microwave system. Computers will, of course, be used in the network, but even more important, this development should foment rapid EDP growth.

Among "have" nations, Australia, with a $1 billion installed base, has become a battleground for U.S., British, and Japanese mainframers. And in Spain, some recent large-scale installations by Fujitsu have given that company a market share equal to CII's, and almost equal to CDC's -- in a base where IBM and Univac share almost 85% of the installed value.

New IDC study

Information on installed bases and computer penetration on a country-by-country basis is presented on the opposite page. General-purpose computers are those commercial machines -- defined and listed model-by-model for U.S. mainframers in EDP/IR, April 22, 1977 -- that usually compete with an IBM 370/115 or up. Small business computers and minicomputers are not represented.

The data has been culled from a recent IDC analysis of the worldwide market. Because of IDC's extensive international file -- complemented by studies from a number of other sources -- this analysis represents a comprehensive world picture of EDP. In addition, the method used to arrive at installed value is consistent from country to country. That is, currency translation and fluctuations, as well as inconsistent system value calculations have been taken into account.

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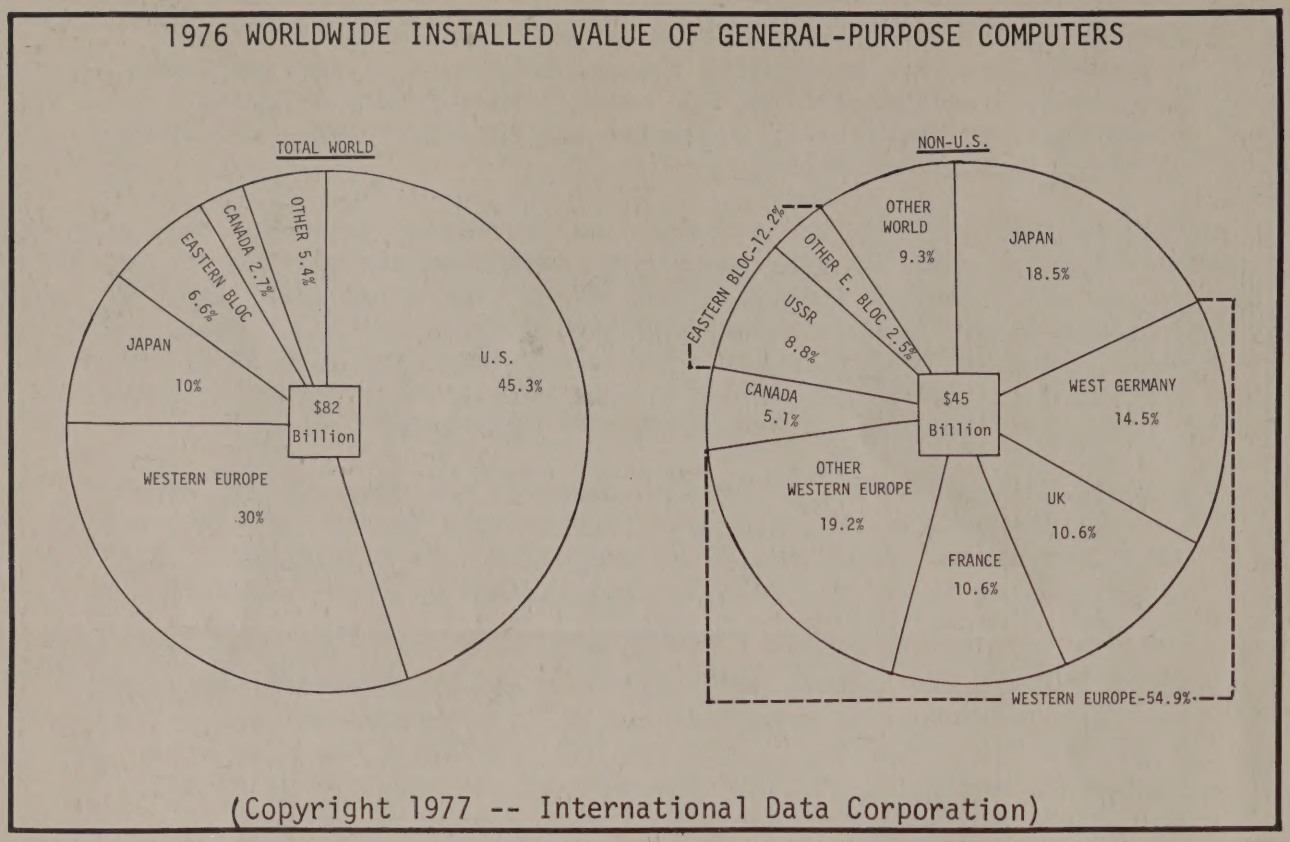

The supplier lineup

IBM, of course, leads the pack, with slightly less of the worldwide value base (62% of the free world) than of the U.S. base. The Giant's extensive service capabilities and financial strengths make it a worldwide favorite; its System/3, and now the System/32 base make IBM a logical upgrade choice for its users. The other U.S. mainframers are much less pervasive, with Honeywell the next largest supplier -- over 7% of the base with CII included. The HIS-CII merger, however, officially completed on July 1, 1976 (EDP/IR,Oct.24,1975), has yet to show any real synergy. But behind IBM, Honeywell is probably the most political of U.S. mainframers, with the oldest ties to European markets and manufacturing. Favortism gained by the French government under the merger however, may be offset by the "buy domestic" plans of other countries prior to the adoption of Common Market liberalization goals that were established last year, and are scheduled to take effect around 1980.

The Russian and Eastern Bloc mainframers, limping along under the Ryad program (EDP/IR,Aug.29,1975), comprise the largest non-U.S. manufacturing block when considered as a single entity (5.7% of the worldwide base) . . . but in actuality, the Marxist mainframers are a fragmented lot, beset with latent nationalisms that preclude their emergence as a potent market force. Only $3 million worth of communist computers are operated outside of the iron curtain.

Britain's ICL and West Germany's Siemens are next in the general-purpose computer rankings, with 2.5% and 2.1%, respectively, of the world market. ICL, the hot-and-cold inventor of virtual storage, is currently introducing a new, broader range of computers, and it has picked up the Singer base in Europe. The company has also been making inroads with its small business system, the 2903,

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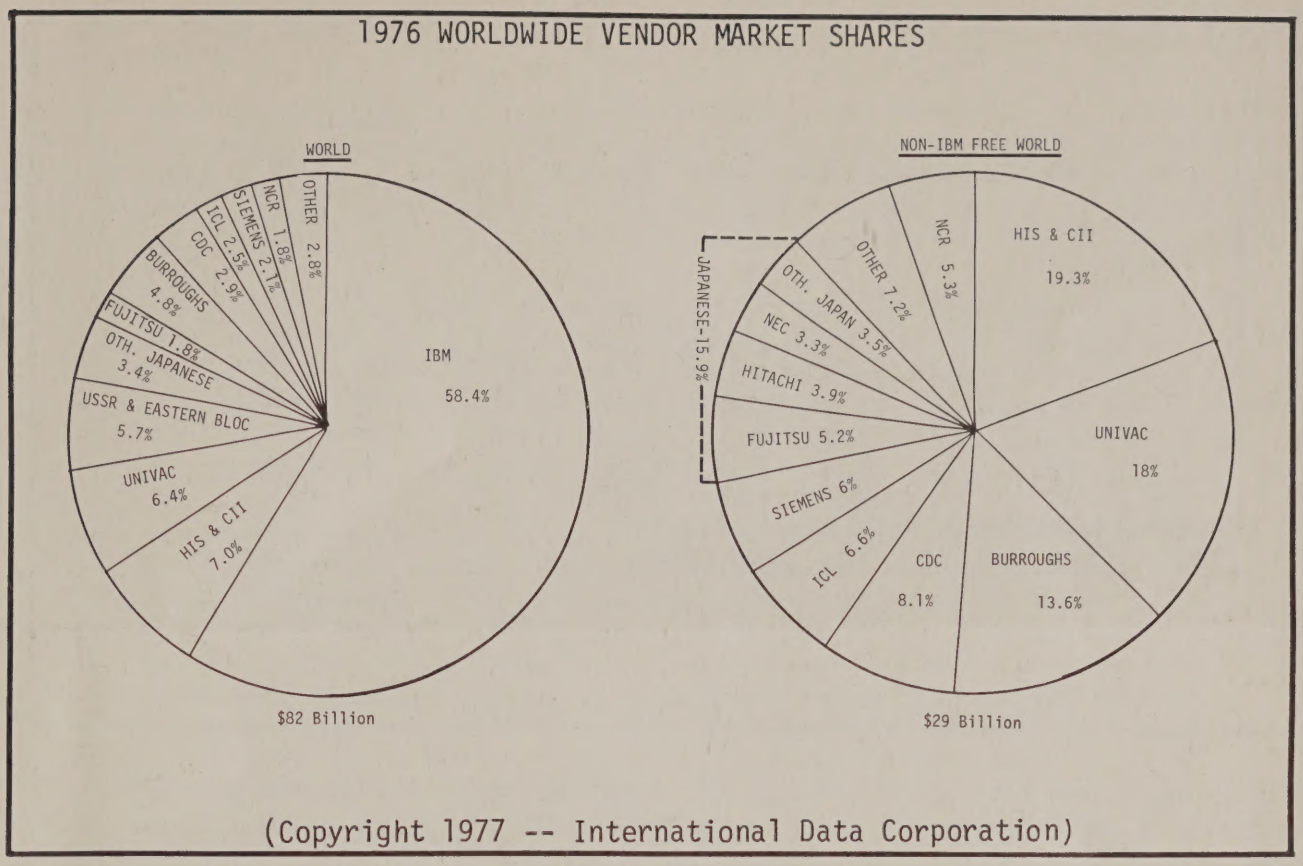

including some installations in the U.S. Siemens, West Germany's largest computer manufacturer, recently entered the U.S. high-speed nonimpact printer market via a pact with Itel (EDP/IR,Aug.19,1977), and also markets other OEM peripherals in the U.S. Belgium and France are the company's second and third largest markets outside Germany. Indeed, in Western European markets outside of their own countries, Siemens out-exports ICL, although the positions are reversed in the total worldwide market.

Other Western European suppliers of note include Nixdorf and Philips. Nixdorf, though not a major power in general-purpose CPUs, has a substantial base of small business systems and accounting machines, and long-time ties to the U.S. market through Victor Comptometer. The company recently acquired Entrex, the U.S. key-to-disk firm, and is reportedly set to announce its own minicomputer. Philips, the Dutch mainframer that abandoned Unidata and virtually dropped out of the mainframe market when HIS merged with CII, is still strong in terminals and datacomm systems.

Considered together -- which many observers do -- the Japanese mainframers command a healthy 16% of the non-IBM free world market (5.6% of the world total). Fujitsu and Hitachi rank one and two, respectively; the former is by far the more aggressive exporter (PCM CPUs are considered U.S.-made). Of more than passing interest is the Japanese mainframers' MITI-sponsored cooperation in semiconductor technology and software development; supported by a MITI-subsidized five-year development plan (that ended this March), the domestic computer manufacturers were able to make great strides, and the EDP industry is currently thriving.

Japan, the world's second leading computer marketplace, is rapidly developing into a global force. Technological advancements in datacomm as well as EDP, and

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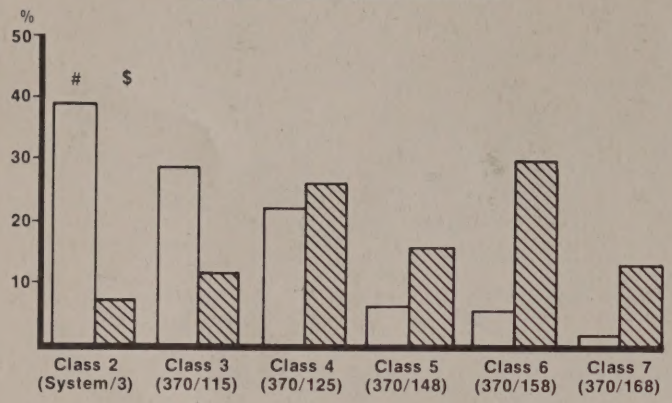
U.S. MAINFRAMERS IN OVERSEAS MARKETS -- SIZE CLASS AND MARKET SHARE (1976)

SIZE-CLASS MARKET DISTRIBUTION



VENDOR MARKET SHARES

Manus.	# CPU	$M Value	% Total
IBM	34,584	21,913	71.3
HIS	7,337	2,594	8.4
Xerox	134	110	0.4
Univac	3,553	2,504	8.2
Burroughs	2,881	1,455	4.7
CDC	494	1,137	3.7
NCR	2,436	756	2.1
DEC	292	196	0.6
Other	1,257	174	0.6
TOTAL	52,968	30,740	100.0
NON-IBM	18,384	8,827	28.7

(Copyright 1976 -- International Data Corporation)

extensive investments in R&D assure its position as a developmental and marketing leader in sophisticated electronics systems. Already it is a force to be reckoned with in the U.S. and other foreign markets, as EDP firms such as Canon, Nippon Electric, Ricoh, Matsushita, and Sharp have set up shop to sell their wares.

The U.S. mainframers

The market shares for U.S. mainframers and a size class breakdown of their 1976 overseas installations is shown above. The size class breakdown resembles that of the U.S. American companies with higher market shares overseas than domestically include IBM, HIS, Univac, and CDC. Some important differences and similarities between the U.S. market and the overseas market (from a mainframer viewpoint) include:

- For the first time, this year's U.S. installed base of Size Class 6&7 (370/158-168) machines will equal (in value) that of lower size classes (370/115-148). In the overseas market, that cross-over point won't be reached until 1979.

- The larger size classes (6&7) will grow more rapidly in the U.S. than overseas. In 1981, these computers will account for over $35 billion of the U.S. base, about $25 billion overseas. Size Class 2 thru 5 machines will account for roughly equal value ($20-$25 billion) for U.S. makers both at home and abroad.

- Overseas users are more rental oriented. In 1976, for instance, IBM's overseas base of general-purpose computers was 66% leased or rented from IBM, versus 36% rented or leased from IBM in the U.S. For non-IBM U.S. mainframers, the U.S. vs. overseas acquisition methods were more evenly divided . . . 44.5% rent/lease from the maker overseas, and 40% rent/lease from the maker in the U.S. Purchases for both markets stood at just under 50%.

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European quandary

Proponents of the European computer industry have long been concerned with the lack of cohesiveness among nations . . . differences seem much more striking than similarities. The European Economic Commission (EEC) -- the Common Market -- began studying the matter three years ago in order to map future strategies for the European DP industry. The crux of its yearend 1976 report is:

- The creation of EEC-wide standards -- through the development of a common realtime language -- should be a high priority. Additional efforts should be aimed at developing "portable" software packages for minis to facilitate their use in networks . . . since this is where the European EDP industry will see its greatest growth -- minicomputers and distributed processing.

- Government procurement policy within the EEC should be directed toward EEC manufacturers where possible, but not limited solely to in-country makers. This policy should be instituted by 1981.

- There should be R&D collaboration between the member states, with a special emphasis on DBMS, programming and security. A leasing consortium arrangement, handled by the European Investment Bank along the lines of Japan's JECC, should be established to break the yoke of IBM's rental/leasing policies.

According to the study commission, data processing, telecommunications, and advanced electronics industries will account for 6% of the member nations' gross national product by 1980 . . . again, with the most explosive growth coming in minis and processing terminals, areas where IBM has yet to seriously impact. The EEC envisions the mini market growing at more than 30% per annum.

Despite this plan, however, the egregious differences between EEC nations seems as noticeable as ever. The Unidata consortium (CII, Philips, and Siemens), which was established to fend off IBM's inroads has dissolved. And the touted non-nationalistic purchasing policies may never progress beyond the planning stages. In the UK, for instance, it's likely that buy-UK policies will actually be strengthened as a result of some recent political pressures (see EDP/Europa Report, June 10, 1977). The establishment of a coherent EEC mainframe policy also appears remote due to unresolved security and privacy issues. Even the EEC's antitrust action against IBM is languishing.

International outlook

For markets, the outlook is strong, particularly in minicomputers and small business systems (not covered here). Developing nations offer a fertile market for first-time installations (with a plethora of political and geographic obstacles to overcome, to be sure); the U.S. offers a sophisticated market for foreign suppliers with the strength or connections to survive the competition.

As for the vendors, the U.S. makers -- with years of experience, should continue to derive larger portions of their revenues from overseas markets. The Japanese should also do well because of determination and cohesive (MITI) direction. European mainframers however, are likely to see the general-purpose computer market remain as foreign-dominated as ever . . . and would do well to follow the EEC's recommendations to enter the newer, less entrenched markets.

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o CALCOMP, LOOKING TO RECONDITION ITS IBM SUIT, has filed an appeal asking the Ninth Circuit Court of Appeals (in San Francisco) to reverse the directed verdict, and to grant a new trial. The Justice Department has filed an *amicus curiae* brief, requesting that Judge Ray McNichols (who directed the verdict) be ordered to explain his reasons for the abrupt trial ending. Following closely behind the recent Greyhound decision (EDP/IR,Aug.29,1977), the Calcomp brief focuses on IBM's use of its monopolistic power.

o AT&T WILL BE RINGING INTO PACKET SWITCHING WITH "BELL DATA NETWORK," according to information and a document obtained by Computerworld, which published details of the preliminary specifications in the Sept. 5th issue. The packet net "type" services will include communications processing functions which will offer users a "feature definition language;" billing will be based on transmission volume, with several delivery standards available -- from 200 msec end-to-end transmission to four hour transmission; terminals and computers will connect at local nodes, and the network will verify data entry utilizing host processor acknowledgement emulation; a variety of access methods and communications software packages will also be available.

o IBM CANADA TRYING TO UNBIND ITS COPIERS WITH XEROX LICENSE following an early August court decision ruling that the Giant's Copier 1 infringes on Xerox patents. The ruling, which gives IBM until Oct. 3rd to remove some of its copiers from Canada, also entitles Xerox to recover damages. Although it is appealing the court decision, IBM is currently seeking a licensing agreement in order to continue marketing its copiers to our northern neighbors.

o INTELLIGENCE IS THE KEY ON A NEW DATAROYAL PRINTER that can generate variable-sized characters without requiring host computer programming. The microcomputer-based system, designated IPS-7200, combines a 120 cps serial printer with an 8-bit microcomputer to create a standalone computer system, or a work station within a distributed network. The IPS-7200 can also function as a label printer, a general-purpose output device, or as a programmable microcomputer, and sells for $3,950 in single quantities, $2,220 in 100-unit quantities.

o CENTRONICS WIDENS ITS LINE OF SERIAL DOT MATRIX PRINTERS with the introduction of the Model 702, a 120 cps, bidirectional, logic-seeking, 132 column printer. The 702, which features five dot matrix patterns and a 10 cpi data format, is aimed at distributed processing and small business systems. It will be available later this year for $2,145. The Matrix Mogul recently reported that its fiscal year after-tax earnings reached $12.2 million.

o JOINING THE HAND AND THE EYE, Lear Siegler's Electronic Instrumentation Division recently acquired the assets of Hydra Corp., a printer manufacturer specializing in communications and peripheral equipment. Lear Siegler, which is one of the largest producers of CRTs, hopes to introduce a complete family of printers through Hydra. Hydra has developed a "ballistic" matrix printhead that uses a completely different approach from the conventional solenoid plunger actuated printheads.

o COWBOYS AND SAMURAI ANYONE? ASKS WESTERN UNION INTERNATIONAL (WUI), which has reached an agreement with Kokusai Denshin Denwa (KDD) that will allow WUI to provide both TV and private line transmission services to Japan. The U.S. firm is also negotiating for other datacomm service between the two countries.

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"THE GRAY SHEET" SEPTEMBER 22, 1977 • VOL.13,NO.6 P.J.McGOVERN,PUBLISHER

Retail stores cashing in

PERSONAL COMPUTER MARKET TO HIT $300 MILLION BY 1980; GROWTH TIED TO APPLICATION SOFTWARE DEVELOPMENT

The popular 1970s aphorism that "small is beautiful" has emphatically been taken to the drawing boards by semiconductor manufacturers . . . and has resulted in the introduction of low-priced, desktop "personal computers." These miniature systems boast memory and processing power that favorably compares with the prodigious configurations that sold for upwards of $100,000 a little over a decade ago. Although the notion of personal computers for the home and office has been bantered about for a number of years by futurists and fiction writers, it wasn't until recently -- when LSI gave us processors-on-a-chip -- that the concept could be translated into a product. And from the first dedicated applications in four-function calculators that cost hundreds of dollars in the early 70s, microprocessors have come a long way . . . to the single-board programmable computers that now hold up to 32K of memory, with 64K being run in the labs.

Thus was the reality of personal computing born. Indeed, the industry is still in its infancy -- it was only three years ago that MITS offered the first microprocessor-based computer kit -- but it is enjoying tremendous growth, and the market potential appears to be quite lucrative. This prospect has already spawned a bevy of specialized, retail computer stores, as well as a number of publications and clubs. Granted, advocates of personal computing tend to be rather vocal, but with exhibitions in every major U.S. city drawing thousands of consumers, and major retail chains like Macys, Sears, and Radio Shack adding credibility by stocking personal computers . . . it's easy to become a believer.

To be sure, the personal computer "craze" is expected to become an appreciable market factor over the next few years. From a 10,000 unit, $5 million market in 1975, personal computer shipments are expected to reach nearly 24,000 in 1977, with a value of over $63 million . . . and to top 100,000 shipments ($300 million) by 1980, according to a study by the International Data Corp. These figures could easily rise 100% if there is a breakthrough in application software development, and inexpensive, useful programs become available to consumers and businessmen.

The projected growth will be fueled primarily by a continued reduction in hardware costs, which will plummet on the wings of the microprocessor/semiconductor revolution. As a result, users will be able to purchase more whistles and bells for their inflated dollars. That is, the sale of low-priced configurations

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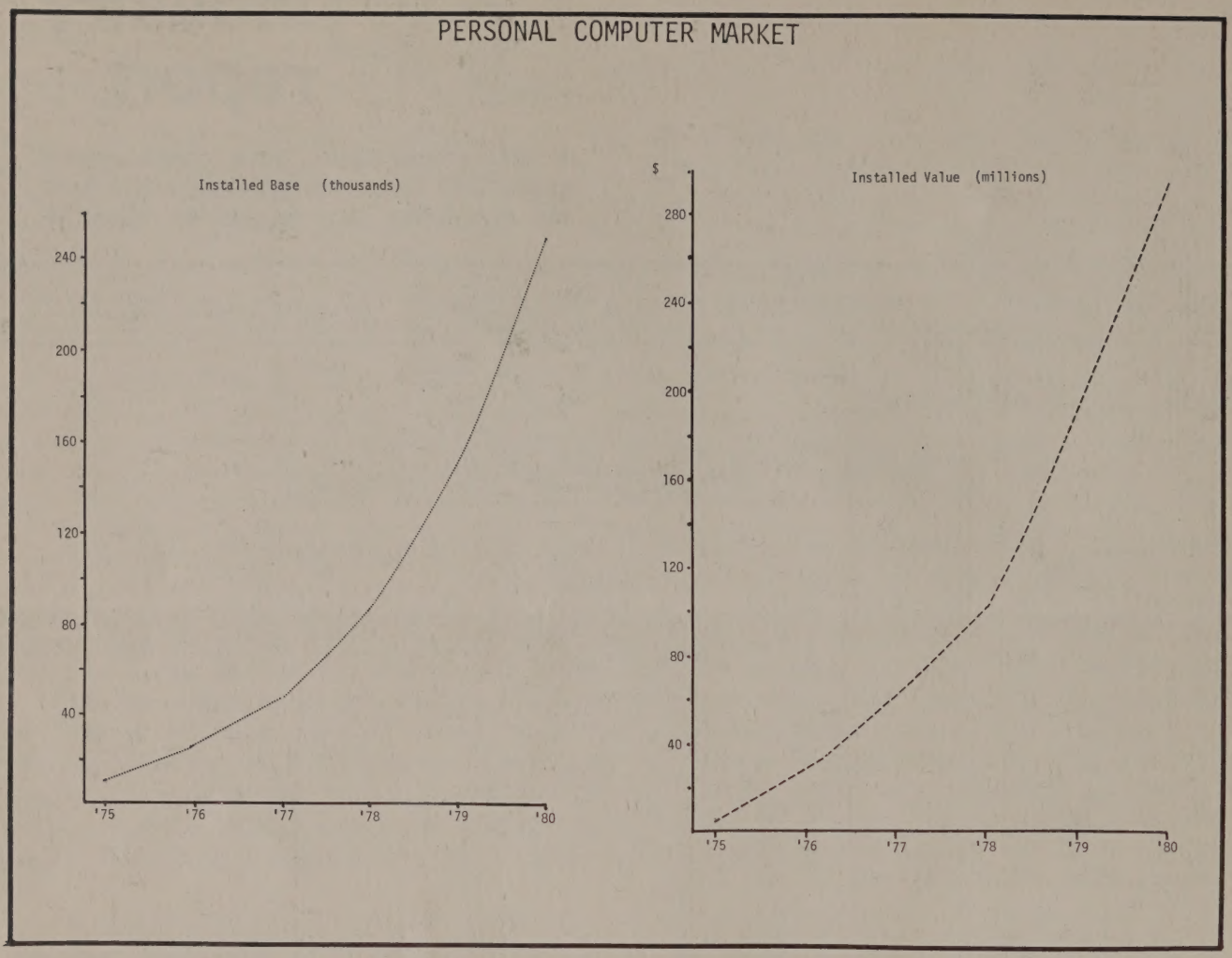

will occupy a diminishing segment of the overall market as users look to add more memory, peripherals (CRTs, disks, printers, communications interfaces), and software packages to their systems. IDC's research indicates that the average user expenditures generally exceed $3,000 over a two-year period, but a high percentage of the users interviewed for this study had built their computers from kits, or from partially assembled components. Expenditures may initially decline with the introduction of integrated modular systems like those from Commodore, Ohio Scientific, and Radio Shack, but it is expected that users will eventually desire more power and options -- adding value to their systems.

Defining the market

The personal computer market is consumer-oriented, and thus differs from the traditional industrial marketplace for minicomputers and microcomputers. The distinction becomes turbid, however, in the competition for the small business market, where high-end personal computers will increasingly challenge the realm of the low-end minis and the microprocessor-based small business computers (SBCs). This categorization dilemma is analogous to the minicomputer versus small business computer distinction that often obfuscates market surveys. The personal computer market includes the following products:

- Computer kits;
- Assembled computers sold by retail stores or mail order;

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- Complete systems with software for small business or home applications;
- Used minicomputers for the home;
- Related peripherals, interfaces, and add-on memory;
- Related software and publications.

Cold chips

Except for a few reconditioned minis, personal computers utilize a microprocessor: Intel's 8080, Motorola's 6800, Zilog's Z-80, and MOS Technology's 6502 are the most popular. Currently, the "typical" low-end personal computer contains a CPU with 4K-8K of RAM, an audio cassette tape interface, a CRT, a keyboard, and BASIC software on ROM (Read Only Memory) -- and is available for under $900. The S-100 bus is also a common component. At the high-end of the market, floppy disk-based systems with a full array of peripherals, and often a number of application software packages, are available for $5,000-$10,000. All personal computers are user programmable.

Although rapid advances in LSI technology will result in further cost/bit reductions, personal computer market revenue growth will probably occur at a faster rate than unit shipments because of increased peripheral usage, add-on sales to the existing user base, emphasis on more costly small business systems, and increased added value at the retail level. This will cause a change in the product mix value. Processors and memory will decline from 52% of 1976 shipments to 47% of 1980 shipments. Peripheral shipments will climb from 38% in 1976 to about 46% in 1980. Indeed, the falling price curve of electronic circuitry is not applicable to printers, CRTs, packaging, media, and especially to software.

Market picture

There are over twenty-five firms that sell personal computers. MITS, which has been acquired by Pertec, is the market leader, with $5.7 million in 1976 revenues, and an estimated 25% of the market share. The firm manufactures a wide variety of kits and preassembled systems aimed at both the home and small business user. IMSAI, a popular kit maker garnered 17% of the 1976 market share (by value), while Processor Technology and Southwest Technical Products managed 8% each. A half-dozen other firms had a 3%-4% share, and the remaining slices were quite diffuse among the rest of the pack.

Because firms offering kits can enter the personal computer market with little or no manufacturing capability, the initial investment requirements are quite low; mail order firms can simply package circuit boards, chips, and instructions, and they're in business -- with very little overhead. In 1975, for instance, 60% of the market value was distributed through the mails. But this pattern is rapidly changing . . . it is expected that only 10% of the personal computer market will be distributed via mail order in 1977, while 33% will be sold through computer stores, 33% through other retail outlets, and 20% through the factory (primarily to OEMs).

The retail edge

This significant shift to retail outlets, along with the increasing availability of integrated "plug-in" systems (at prices rivaling comparable kits), has put added competitive pressure on many of these smaller, mail order-specialized firms. Most of these firms (almost 80%) have been in business for less than three years, and over one-third have less than 25 full- or part-time employees. As the

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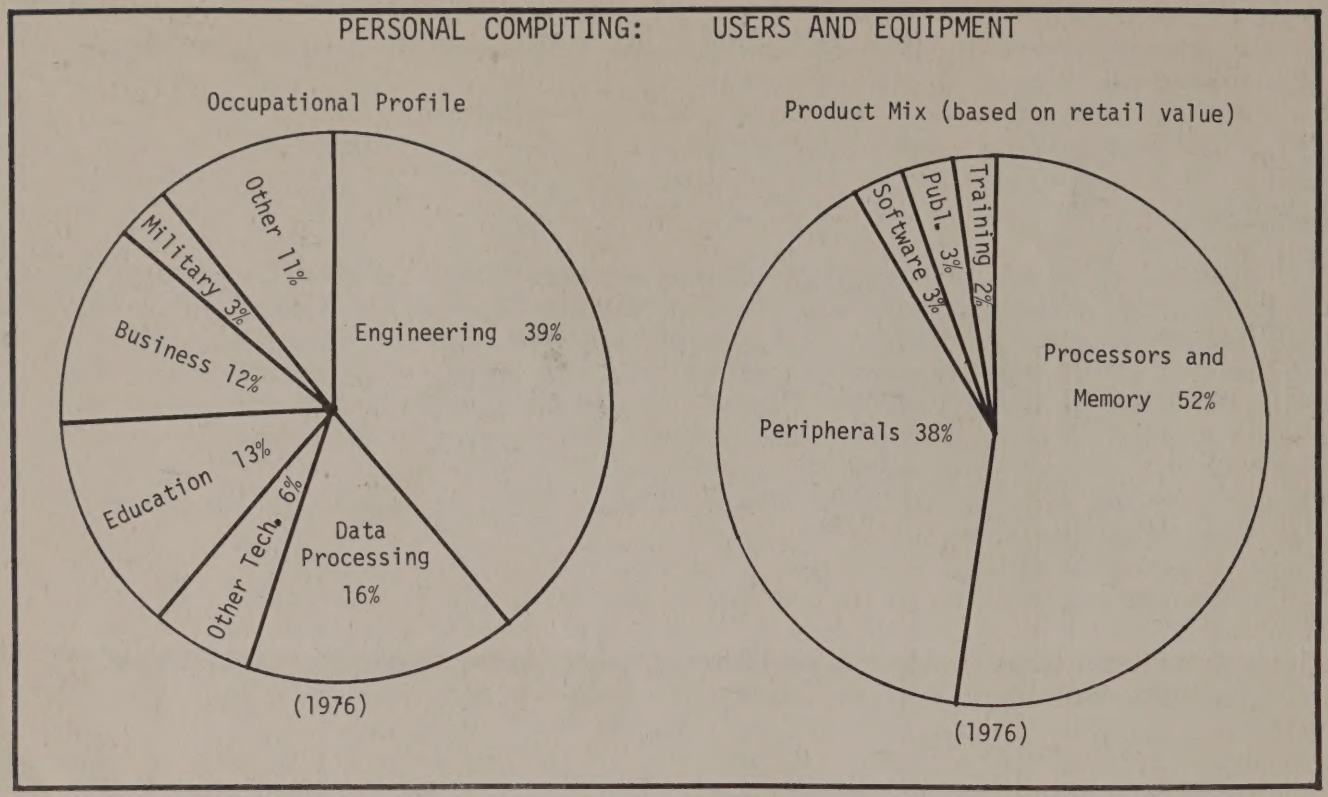

market continues to mature, the kit, or "hobbyist" market is expected to level out, and those firms catering to this segment will be forced to change their tack, and to enter the more competitive retail product sector. This move will require more capital investment in manufacturing and production. And with a tightening economy, lenders and investors will become scarce, and there will likely be a supplier shakeout sometime during the next few years.

It is not at all surprising that the retail computer store developed out of this high growth industry. Mail order is a hobbyist mode, because after receiving the product, the user is basically on his own. But the average home or small business users need more support. Local stores provide a firsthand selection of products, service and repair facilities, knowledgeable people to explain the intricasies of the systems, related peripherals, publications, and software packages, and often offer training sessions (sometimes for a small fee). Byte, with over fifty stores nationwide, will probably account for over 20% of the retail sales during 1977.

Toward complete systems

The personal computer market shift towards integrated systems will gain added momentum with the recent introduction of sub-$600 systems from Commodore and Radio Shack -- dubbed PET and TRS-80, respectively. The PET is a 4KB (expandable to 32KB) machine with a 9-inch CRT, cassette storage, and 73-key keyboard. BASIC is resident on ROM. The PET received considerable interest at NCC '77, and a number of orders have been placed. Although deliveries were supposed to begin by the end of the summer, they have been delayed a number of times -- Commodore appears to be having difficulty with mass production.

The Radio Shack TRS-80 is the most promising low-cost system to enter the personal computer market -- and shipments began on schedule a couple of weeks ago.

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The basic system configuration is similar to Commodore's, but the keyboard is easier to use. In addition, five home software packages on cassette tape (from $5-$20) are already available, allowing the user to run personal finance, 15-employee payroll, inventory, and educational programs. But the real advantages of this modular system are yet to come -- in December, Radio Shack will offer an expansion module with 64KB capacity, and a mini-floppy disk drive and Disk Operating System, the latter for about $700. FORTRAN will be available on disk for under $100, as will a number of business-specialized software packages. Two matrix printers, one below $700, the other below $1500, will also be unveiled, along with a modem, an assembler/editor, and Level II BASIC. Indeed, by next year, the TRS-80 could be configured into a 32KB dual floppy, printer system for under $3,500! If Radio Shack/Tandy delivers the business software packages as promised, the electronics hobby mogul could easily become the most potent force in the personal computer market because:

+ It is the first manufacturer to deliver a complete, modular, low-cost personal computing system with systems software and real applications packages (as opposed to just games) available;

+ Its marketing organization and retail outlets are already established and well-respected;

+ It has vast experience in electronic component marketing and servicing; maintenance and repair service will be accomplished in its regional repair centers, and will take about a week;

+ It is easily the largest retailer to enter the marketplace, and will be carrying other lines of computing equipment as well.

Software blues

With the exception of hobbyists and EDP-types, the majority of consumers do not want to program their own computers -- the prospect of learning computer languages and algorithms is too frightening for uninitiated users. Indeed, both consumers and businessmen want to buy solutions, but currently, microcomputer software solutions are limited beyond a few simple programs. There is thus a desperate need for good applications programs.

But the microcomputer is still in its primitive stages; the architecture is a compromise, and is often confusing. As a result, programmers must often start from scratch in writing programs, and they still experience difficulty maneuvering data in a desirable format. Higher level languages do not yet exist for microcomputers; PL/M and BASIC, and a trickling of FORTRAN are the only languages that are presently available to users . . . and these are often cumbersome and don't mesh with specific application requirements.

In addition, there is a paucity of skilled microcomputer programmers (the trend for mainframe software development has been toward higher-level languages, while the micro requires stepping back to basic machine and assembly language), little manufacturer support (by the semiconductor manufacturers) and limited software development tools. These are the major reasons why microcomputers are so expensive to program . . . and why applications programs are still scarce. To be sure, while hardware costs continue exponentially to tumble, software development costs are on a steady upward climb -- swallowing an ever-increasing chunk of the EDP dollar.

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New developments

For the personal computing industry however, the lack of programs may not last for too long. First, most home and small business applications can be handled by relatively simple programs, and if personal computers develop mass market appeal, software development costs can be sprinkled into the hardware systems, and into the sheer number of packaged software disks and cassettes that will be sold to users. In addition, creative types will write their own programs -- and sell them to national distributors, who will check them out, and offer them by mail or through retail outlets. In a few years, buying software for your personal computer may be as easy as purchasing a phonograph record.

Other personal computer software advances will likely include development of utility programs, such as: cross reference, file compare, file recovery, debugging, maintenance, sophisticated editors, etc. These tools will enable easier programming on both the user and manufacturer level. Many, in fact, can be incorporated into the machines (and be transparent to the user) through a properly designed language package.

Another avenue for software is microcomputer emulation of minicomputers, using the latter's vast store of application programs. Moreover, semiconductor makers can add value to their chips by "hardwiring" some instruction sets into the hardware. For instance, a recently introduced single-chip floating point arithmetic package that plugs into the micro system bus saves over 500 instruction steps. It is expected that by 1980, specialized I/O driver chips will be able to carry their own software in ROM -- and to perform an increasing amount of the program commands. Cheaper memories will alleviate some of the cost-impact of higher-level language programming; that is, inefficient memory usage will no longer be considered a mortal sin.

User evolution

Although there is some overlap, personal computer applications can be categorized into three user segments:

+ Small businessman;

+ Home or small business hobbyist;

+ Home utilitarian/experimenter.

It is no coincidence that the majority of current users (61% according to the IDC survey) have a data processing, engineering, or other technical background -- since most of the personal computers that have been available to them have been in kit form, and required user programming. With over 300,000 "computer specialists" in the U.S. (according to Labor Dept. statistics), this group represents a natural market, particularly since many of them work with large computers, but are unable to utilize them for their own processing requirements. Personal computers have given these people the opportunity to explore a challenging hobby, and concomitantly to satiate some of their EDP thirst . . . for about the cost of a color TV or a good stereo system. It is expected, however, that the hobby kit market will soon begin to decline -- partly from saturation, but primarily due to competition from inexpensive integrated systems. Hobby kits will be viable only for the add-on market. This user segment will nonetheless be a major consumer in the home and business personal computer as utility and entertainment market.

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Small business boon

The small business computer market is a prize being sought by personal computer, minicomputer, and microcomputer manufacturers. With nearly 3 million businesses in the U.S. employing less than ten people and grossing under $500,000 in annual sales, this market segment appears particularly lucrative. Until very recently, personal computers did not even begin to offer solutions to the businessman, who had to look to the larger manufacturers like DEC, Data General, Basic Four, and IBM to meet his needs . . . and it could be argued that the $15,000-$50,000-plus systems could not possibly be amortized in work saved or efficiency gained for smaller outfits.

The personal computer systems (like Radio Shack's) selling for under $600 are certainly not the answer to a businessman's needs, but because they are modular, they present an excellent cost-solution for introducing the uninitiated consumer to data processing -- and they can be developed into true business systems at a later date. Complete small business systems for $5,000-$10,000, supported by low-cost application software packages are now available from only a few manufacturers (such as Olivetti, MITS, and IMSAI), but within a year, they should become more abundant, and prices will fall even further as manufacturers vie for position.

With the small business computer market projected to be one of the fastest growing industry segments during the next few years, the minimakers will certainly join the fray; they will likely adapt their software inventory to microcomputer emulations of their large CPUs, and target them at the small businessman. These small systems will eventually be able to accommodate word processing functions, and with communications interfaces, the user will be able to access large data bases . . . and perhaps be configured into distributed processing networks that could put an inexpensive processing terminal on every desk in an office or business.

An information appliance

The introduction of sub-$600 computer systems with the beginnings of inexpensive application software has suddenly made personal computers attractive as a home utility, and as a source of entertainment. Adults can use them for a variety of financial applications, lists, and games, but the computers can also serve as an educational tool -- children can execute a variety of lessons on them, and learn to write their own programs as well; games and problem-solving would also be attractive to them. This user segment has tremendous market potential if/when systems decline to the $100-$300 level, and the devices can be utilized as interactive receiving sets, providing outside sources of information and entertainment.

Indeed, the brightest prospect for the home computer lies in its use as an information appliance (for on-line access to outside resource material and data bases); and because this utilization will require telephone linkups, it is likely that AT&T will direct some attention to this market. Service vendors and terminal makers will also vie with personal computers for the interconnect appliance market, and in many cases, the actual "computer" portion of the device will be transparent to the average user.

Computer power may well be the watchword of the 1980s, as a generation weaned on calculators and electronics begins taking advantage of the available technology -- in their livelihood, and in their homes. Personal computers represent the ultimate common denominator in data processing -- mass cybernetics -- and this bodes well for the established EDP industry.

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• SYCOR'S 290 SERIES TAKES ON THE 3270 -- an even match on the hardware side, but the new terminal can be leased for 25% less than the IBM model. It can also replace 3270s on host computers with no reprogramming. The microprocessor-based 290 is available in three versions, the 291, 292, and 296, for either remote or local channel use. The 291 and 296 remote configurations can use either BSC or SDLC line protocols, with transmission speeds from 1,200 to 9,600 bps.

• PERKIN-ELMER'S MODEL 650 "PUSSYCAT" STALKS THE LOW-COST PRINTER MARKET. The 100 cps, full page thermal printer can produce hard copy off of 1920-character CRTs in less than 20 seconds. The fully buffered, micro-controlled printer has only one moving part, links up with any CRT with RS232 interface, and costs under $795 in quantities of 75. Interdata, a P-E Data Systems division, has introduced the Model 8/16E processor, a 16-bit system that can address 256KBs of memory.

• UNIVAC COMPUTERS TO RENDEZVOUS VIA AMERICAN SATELLITE CORP., for the first small antenna datacomm link using spaceships. Scheduled to become operational in the second quarter of 1978, the system will link development centers in Blue Bell, Pennsylvania with facilities in Roseville, Minnesota. Small (4.5 diameter) antennas will be used for both send and receive.

• FORRO PRECISION CLEANS AND PRESSES IBM SUIT FOR $2.7 MILLION as recompense for general damages resulting from the Giant's intentional interference with Forro's prospective business relations. IBM was awarded $260,777 on its cross-claim against Forro charging misappropriation of trade secrets. Significantly, the jury was unable to reach a decision on whether Forro had been victimized by IBM's alleged antitrust, monopolistic practices. Forro is seeking a retrial on this issue, and both companies are appealing the monetary decisions. On other legal fronts, Xerox Corp. has granted IBM Canada a license, allowing the latter to resume marketing the Copier 1 that had been found to infringe on Xerox patents.

• IBM REVISES PRICES ON SOME PRODUCTS AND SERVICES as a result of "a normal business review." The Armonk mainframer slashed up to 25% off of the purchase prices of its aging lineup of keypunch/verifier machines that are steadily losing ground to data entry terminals. About thirty products are involved, including: the 026, 029, 129, and 5496. Up to 10% lease and rental increases were registered on computer printers, printer controllers, and older banking equipment, including: 3211, 3811, 1403, 1056, 1203, and 1282. Up to 18% increases in contracted monthly maintenance costs were recorded for: the 1401 and most system 360 CPUS, the 1403 and 3213 printers, 360 family disks, 2740, 3776, 2260, 2741, 3767, 3610, 11, and 12 terminals, and System 3/4. Up to 20% decreases in contracted monthly maintenance was noted for the 370/155 and 165, System 3/15, 8, and 6, and for all models of the System 7. In addition, there were 18% across-the-board increases for noncontracted maintenance service. The latter prices are effective immediately, as are the keypunch reductions. Other maintenance adjustments become effective this Saturday, and other price adjustments begin January 1.

• HONEYWELL FOLLOWS IBM LEAD, RAISES MAINTENANCE AND PROGRAMMING LICENSE FEES. Two days after IBM's announcements, Honeywell raised its maintenance prices 6%-15% and its programming license fees about 5% for most of its computer systems, including the Series 60, but excluding the Level 6 minis. Purchase prices and monthly rentals will also climb 2%-7% on older minis; Series 200 and 2000 computers, and a few Series 60s will be effected only by the rental increase. Fees will rise 9% for users of Honeywell's Datanetwork.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" OCTOBER 21, 1977 • VOL.13,NO.7 P.J.McGOVERN,PUBLISHER

3031 AND 3032 FILL GAPS IN IBM'S CURRENT PROCESSOR GENERATION; ITEL AND AMDAHL RESPOND IN KIND; OTHER ANNOUNCEMENTS EXPECTED

When IBM kicked off the fourth quarter with its announcement of the 3031 and 3032 processors, no one was surprised at the facts. The announcement of at least one CPU between the 370/148 and the 3033 (EDP/IR Mar.29,1977) had been expected for some time. Even the details of the new uniprocessors fit general expectations:

+ The basic cycle time is 115 nanoseconds for the 3031 and 80 nsec. for the 3032. Both feature 32,768 bytes of high-speed buffer storage -- equal to that available on the 168-3, double the capacity of the 158-3.

+ System/370 Extended Facility is a standard feature. When utilized by IBM's MVS/System Extensions program product ($1250/mo.), it offers 14% performance improvement through reduced supervisor path lengths, more effective resource control, and reduced software contention.

+ The 3031 comes with two to six megabytes of main storage, in one megabyte increments; the 3032 can have two, four, or six megabytes. Four-way interleaved storage gives significantly faster data rates.

IBM says there is no new circuitry in the processors -- they rely on the same Mosfet memory (priced at the same $110,000/Mbyte) and the same Monolithic System Technology as the 158-3 and the 168-3; the denser logic chip announced for the 3033 is not used. The 3031 has air cooling, as does the 158; the 3032 uses water, as does the 168. The surprises are in what was not announced:

• No multi-processing capability (the new processors can be loosely coupled via a channel) even though this is considered by most observers to be the direction of large processors in the future.

• No cut in memory prices, even though a drop to the $75,000/megabyte level was signaled last spring by incremental pricing from GSD.

• No major software enhancements or the adaptation of significant software routines (such as VTAM) to microcode within the mainframe.

It would seem, therefore, that IBM's new general-purpose instruction processors have been announced but that there are some architectural and/or memory announcements to come. Additional memory capacity seems almost a necessity; lower

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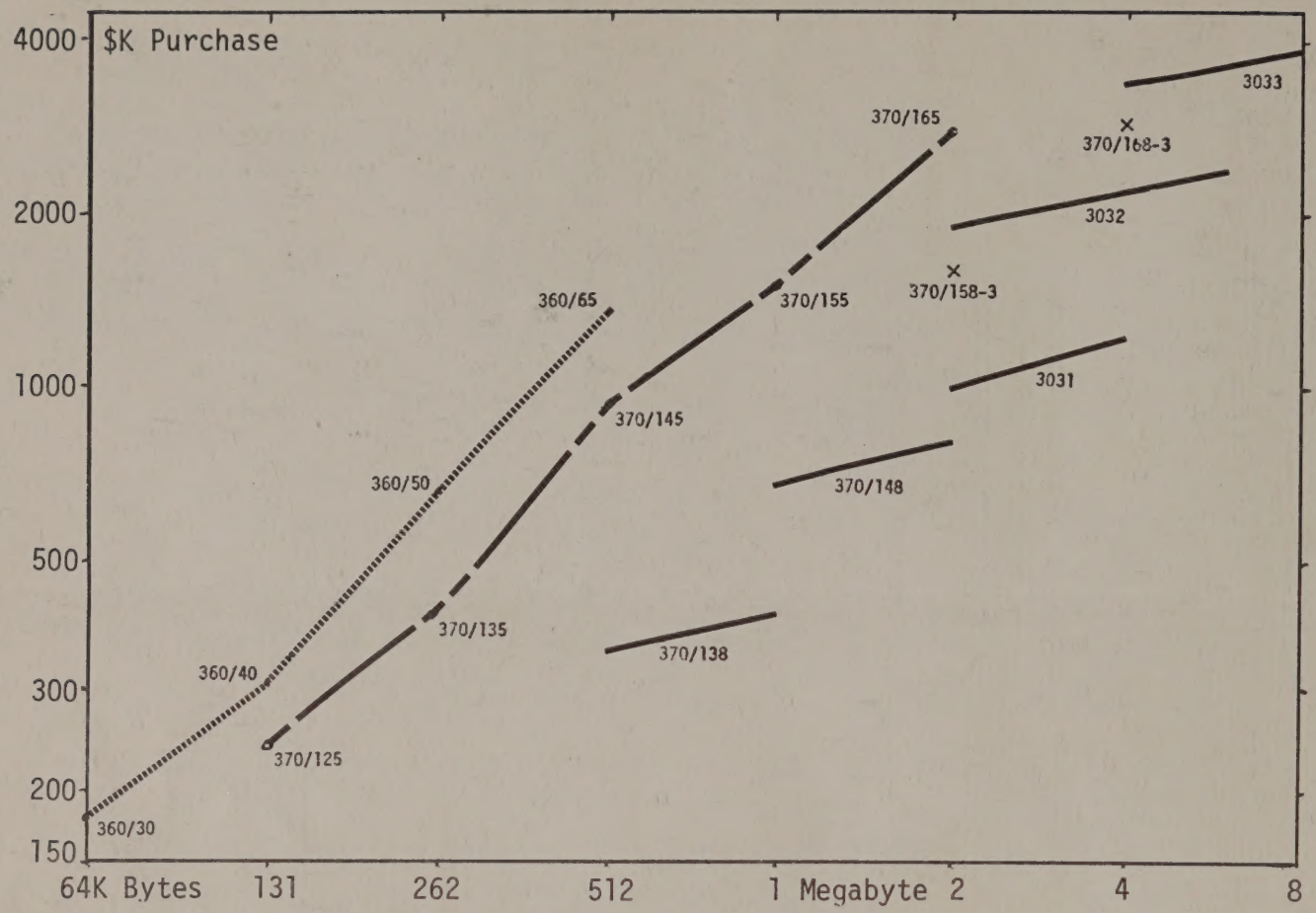

IBM SYSTEMS continually give more "bang for the buck" as the graph shows. Points plotted for older systems reflect the memory size and price shown in the table, opposite. For CPUs currently in new production, the price throughout the memory range indicates the $110,000 per megabyte memory price currently being charged.

memory prices (or new technology, with far more memory in the same size box at the same price) would appear certain before long. And almost all observers say multiprocessing will be announced within the next six months or so.

In any event, the announcements of the new processors came as no surprise to IBM's two primary competitors these days -- Amdahl and Itel. Both had their answers waiting in the wings and were able to announce competitive versions virtually moments after the IBM announcement came over the wires. Amdahl "concluded the new products were replacements . . . saw no reason to modify existing 470 line product plans" . . . and upped production to five a month. Itel announced the AS-6 Model 7032, priced about the same as the 3032 and offering about 10% more performance. Deliveries are about the same as for the new IBM processors.

So the marketplace parameters are set. IBM will begin shipping its new CPUs during the first quarter of 1978, and by the end of 1980 IDC would estimate that some 2500 of the 303X processors will have been shipped within the U.S. Current research would indicate the distribution of these to be 700-1,000 each, with the 3032 being the most popular. International shipments could be almost as large. Compatible manufacturers can maintain shipments at current rates (100+ in at year-end, reasonable growth thereafter) without impact -- or take some market from IBM. The demand for more computing power still seems to be insatiable.

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HOW THE NEW PROCESSORS FIT INTO THE PICTURE

The concept of relative CPU power is one of those computer industry institutions that nobody really understands but that everybody demands. And, of course, the more simply any relationships are stated the more easily they are misunderstood.

For several years now, IDC has been maintaining a set of relationships among IBM processors. Upon announcement of the 3031 and 3032 processors, EDP/IR set out to reexamine the existing relationships and to restate them as meaningfully as possible. IBM was helpful in discussing relative performance between various sets of processors. From the discussion -- properly hedged with "in the majority of cases . . . with similar job streams . . . running under specific operating systems" -- IDC has revised its relative ratings on a scale where the 370/148 is 20 and the 3033 is 200. These are compatible with the previous ratings for IBM 360 processors published by IDC. Also, in the listing below, IDC has selected a particular memory size that gives a doubling for successively larger processors and, in the case of the CPUs that are in use, generally reflects the average system installed.

Relative Performance (370/148=20)	Model	Memory Size (Megabytes)	Mainframe Purchase Price ($ Million)
1.75	360/30	.064	$ 178
3.5	360/40	.131	307
9.0	360/50	.262	663
22	360/65	.512	1,360
4.4	370/125	.131	$ 241
8	370/135	.245	413
16	370/145	.512	940
31	370/155	1.0	1,515
82	370/165	2.0	2,808
39	370/158	2.0	$1,546
45	370/158-3	2.0	1,613
109	370/168	4.0	2,642
118	370/168-3	4.0	2,883
10.4	370/138	.5	$ 350
20	370/148	1.0	689
52	3031	2.0	$1,000
118	3032	4.0	2,142
200	3033	8.0	3,825

In addition, IDC has fit the performance claims of Itel and Amdahl into the same scale used above. These numbers should assist the reader in placing the IBM-compatible CPUs into perspective:

AS 4	28	470 V-5	130
AS 5-1	39	470 V-6	177
AS 5-3	45	470 V-6-2	200
AS 6	130	470 V-7	320

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COMPUTER SERVICES CONTINUE TO SHOW STRONG GROWTH AS VENDORS USHER IN MORE REMOTE OFFERINGS AND SOFTWARE PACKAGES

Computer services -- those vendors that add value to EDP hardware and communication resources to serve the needs of the end user -- rung up $5.33 billion in 1976 revenues, and $573 million in profits . . . according to a recent study by International Data Corp. for the Association of Data Processing Service Organizations (ADAPSO). The services industry is broken up into four sectors which reflect respective service offerings:

+ Processing Services

+ Software Packages

+ Staff-Support Services

+ Facilities Management

Taken together, their compounded revenue growth rate for 1976 approached a very healthy 18% (compared to 16% in 1976); profits were up only 11%. The differential between revenue and profit growth is indicative of investments in new products and services, as well as increases in operating expenses. This investment, however, bodes well for the industry, since the incorporation of state-of-the-art technology is crucial in making EDP services attractive to users -- in lieu of in-house alternatives.

Indeed, EDP services now accounts for over 17% of the total U.S. EDP user expenditures, and expansion is expected to continue well into the 1980s. In 1977, the compounded revenue growth rate for services will grow to about 19% over 1976 figures, on sales of $6.3 billion. This percentage increase is about 2%-3% higher than predicted growth for the total EDP industry, and thus services will continue to garner a greater share of the EDP dollar. With an annual growth rate of about 18% over the next five years, service revenues are forecast to reach $10.4 billion by 1980, and to climb over $12 billion by 1981.

Vehicles for growth

The major factors influencing this muscular growth by the services industry in 1976 include:

- Continued economic recovery brought about by greater outside spending for computer services -- enabling more external services;
- Improved software product offerings, particularly in packages;
- New products and services in datacomm and distributed processing have expanded the potential customer base;
- New and enhanced specialized offerings with improved price/performance values;
- More sensitivity to the first-time user market;
- Better utilization of minis, micros, and intelligent terminals, particularly in developing networks.

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EDP SERVICES INDUSTRY: REVIEW AND FORECAST

Product Category	% Total Represented 1976	1976	% Δ	1977	% Δ	1978	% Δ	1979	% Δ	1980	% Δ	1981	% Total Represented 1981
Processing Services	68%	$3,605	17%	$4,217	19%	$5,019	18%	$5,923	17%	$6,930	16%	$ 8,038	67%
Software Packages	10	550	33	731	30	951	28	1,217	25	1,522	22	1,856	15
Staff-Support Services	13	675	12	756	11	839	10	923	9	1,006	8	1,087	9
Facilities Management	9	495	19	589	18	695	15	799	14	911	12	1,020	9
TOTAL	100%	$5,325	18%	$6,293	19%	$7,504	18%	$8,862	17%	$10,369	16%	$12,001	100%

The influx of minicomputers, microcomputers, small business computers, and intelligent terminals onto the EDP marketplace, offering users inexpensive on-site processing opportunities, would at first glance appear to be a *bette noir* for service vendors, but many have managed to turn the new hardware to their advantage by offering it as part of their services. Moreover, most of this new hardware (minis, terminals, etc.) arrives from the manufacturer as a panoply of cold iron . . . requiring programs, and often operating systems to make its bells and whistles perform as they're supposed to. This accounts for the outstanding performance of packaged software services in 1976.

In addition, many organizations, particularly EDP newcomers, look to service vendors because they provide attentive service that is usually user-specific. They are willing to "handhold" first-time users, and to initiate them into the complex world of data processing. And with more small businesses now searching for inexpensive means to solve their financial and inventory problems, service vendors look particularly attractive. Also, the user has more time to assess his real needs, evaluate the available hardware options, and in general become more educated about DP . . . in lieu of a major vendor-inspired hardware expenditure. It has, in fact, been noted that many of the local service bureaus have become so specialized that they often know more about the user's business than the user himself, and this greatly enhances their total value. The same cannot be said for the hardware vendors, particularly the minimakers, who are generally reticent when it comes to involvement with end-users.

Turnkey systems, and configurations provided by OEM Systems Houses (see the EDP/IR,May 31,1977), as well as some of the newer small business systems with applications packages provided on floppy disks, provide some of the stiffest competition for service vendors in this marketplace. In addition, interindustry competition keeps keeps service bureaus on their toes.

An available alternative

For medium- and large-scale users, service vendors provide an inexpensive means to handle occasional DP overflow, or intermittent specialized services. In addition, some organizations turn to service bureaus to experiment with new configurations and innovative programs -- before in-house implementation. Indeed, because service bureaus serve a number of customers, they can more easily amortize the cost of new, state-of-the-art equipment that customers have expressed an

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interest in using. Also, a number of organizations with in-house DP departments turn to service bureaus in order to avoid the interdepartmental difficulties that often result when DP time must be divided within their companies -- a given department often finds service bureaus to be more attentive, faster, less hassle, and occasionally less costly. Finally, even large companies often don't have the resources for extensive software development, and thus turn to service vendors for solutions .

Processing services continue to dominate

The EDP services industry revenues were once again led by data processing services -- with $3.6 billion, or 68% of the services pie; growth was 16%. This segment is expected to continue its hegemony, with an average revenue growth of about 17% over the next five years. This growth will be fueled, however, not by traditional raw computer time and its associated batch processing, but by specialty products (53% of 1976 processing revenues) targeted toward remote services such as interactive problem-solving and autotransaction . . . more responsive modes that are geared to solving industry-specific problems -- often better than the users' in-house operations. These modes will be implemented through incorporation of minis, micros, datacomm, terminals, and DDP into service offerings. Data base and general-purpose products will also contribute to accelerated growth, as this segment climbs to over $8 billion in 1981 revenues.

Facilities management services experienced a 19% revenue increase in 1976, on revenues of $415 million (9% of the total). It is forecast, however, that the growth rate will decline to about 12% by 1981. Because the users served by this segment are diverse, facilities management outfits are unable to take advantage of the economies of scale in reaching wider portions of the market with the same product (as packaged software and processing vendors can do). This segment also faces the stiffest competition from minis and intelligent terminals (which allow cost-effective remote access to mainframes), and from proliferating user expertise. Nonetheless, revenues should grow at an average annual rate of 16% through 1981, and reach $1 billion by that year.

The software picture

Staff-support services managed $675 million in 1976 revenues (about 13% of the total), the majority of which was derived from custom/contract software. This segment, which grew only 11% last year (slowest among the four product categories), reflects the unique problem of developing highly specific user programs -- often a lengthy, costly process for the vendor, who must remain competitive with other user alternatives. System development work encounters similar difficulties. Although these services represented 55% of total software revenues in 1976, and will grow at a steady 10% clip through 1981, by that year, packaged software will cull almost 63% of the software revenues.

Software packages had a banner year in 1976, netting $550 million in revenues (10% of total services), for an industry-leading 34% growth rate. This significant advance is attributable to users "no longer trying to reinvent the wheel" -- taking the slow, costly, in-house route for developing all their programming needs. In addition, it reflects user efforts to accommodate their needs with the less expensive packages that can be plugged into their systems with little modification . . . as opposed to expensive custom development. Moreover, software vendors are becoming more sensitive to users' needs, and to gaps left in the software provided by hardware manufacturers. To date, over 230 software packages have topped the $1 million

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COMPOSITION OF EDP SERVICES INDUSTRY: BY PRODUCTS OFFERED AND COMPANY SIZE

Products	Large Companies				Medium Companies				Small Companies				All Companies			
	Processing*		Software**		Processing		Software		Processing		Software		Processing		Software	
	Rev.+	Co.++	Rev.	Co.	Rev.	Co.	Rev.	Co.	Rev.	Co.	Rev.	Co.	Rev.	Co.	Rev.	Co.
Processing																
Raw Computer Time	12%	46%	10%	40%	22%	60%	5%	53%	3%	26%	3%	24%	12%	43%	6%	37%
General-Purpose	8	40	1	40	14	40	2	27	16	37	2	10	13	39	2	20
Specialty Products	67	87	1	40	40	80	7	47	53	74	7	38	53	80	5	41
Data Bases	8	40	2	40	8	33	1	13	10	21	1	14	9	31	1	17
Packaged Software																
Applications Packages	3	46	7	60	6	53	27	67	8	58	36	71	6	53	23	68
System Packages	Neg.	13	56	80	Neg.	7	14	40	1	16	24	33	Neg.	12	31	41
Staff-Support Services																
Custom/Contract Software	2	53	19	60	8	53	35	87	7	58	23	62	6	55	26	71
Consulting/Education or Training	Neg.	20	4	60	2	27	9	80	2	37	4	43	1	29	6	59
TOTAL	100%		100%		100%		100%		100%		100%		100%		100%	
Avg. No. of Services Offered		3.5		4.2		3.5		4.1		3.3		3.0		3.4		3.5

*Classified as Processing or Software/Staff-Support according to majority source of derived revenue. Multiple product companies -- whose revenues were from many diversified services -- were classified in the Software/Support categories.
**Software represents Software/Staff-Support/and Multiproduct Companies.
+Rev. = % Revenue Each Product Category Represented.
++Co. = % Companies Offering Each Category.

mark, and by 1981, this segment's revenues are expected to top $2 billion, as it continues to pace the service industry in growth rate.

Industry structure

Although there are over 2,500 companies currently in the services industry, mergers and acquisitions are creating a group of particularly large, strong companies -- Control Data, Computer Sciences, Automatic Data Processing, Electronic Data Systems, System Development Corp., and GE/ISBD. These firms each registered over $100 million in 1976 sales, and together accounted for about a quarter of the service market revenues.

Indeed, large companies (revenues greater than $10 million) accumulated 51% of the industry's revenues, with only 2.5% of the companies. Medium-sized firms (between $2 and $10 million in revenues) which account for about 11% of the service companies, managed almost a 25% revenue share, while small firms (under $2 million in revenues), with about 86% representation, took only 24% of the pie. Moreover, while larger firms' 1976 revenues grew at 21%, medium- and small-sized companies had to settle for 14% and 10% growth, respectively. This uneven distribution of revenues will grow even further in the near future as smaller firms, unable to compete with the state-of-the-art product offerings and quantity discounts offered by their larger brethren, will be acquired, or head for cover under Chapter 11. And if IBM moves into datacomm through its SBS connection, the services market could consolidate even further, with Armonk becoming a major magnet, perhaps as early as 1979 or 1980.

(The 1977 Annual Report on the Computer Services Industry, which analyzes this topic in depth (charts, numbers, graphs, industry breakdowns, etc.), is over 100 pages long, and is available from IDC, P.O. Box 915, Waltham, Mass. 02154. It costs $395.

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• "MEMORIES ARE MADE OF THESE," SAYS DEC of its new KT8-A and MS8-C modules that allow most current PDP-8As to be upgraded to 168K-word capacities. The MS8-C is available in both 16K- and 32K-word configurations (using 4K RAMs), priced at $1,900 and $3,100, respectively. The KT8-A is a memory management option that can be incorporated into configurations using at least 32K-words of core, MOS, or mixed memories; it costs $1,750. The Maynard Minimaker also unveiled three new low-cost PDP-8A processors -- the PDP-8A/205, 425, and 625. Prices range from $3,900 for a 16K-word 205 to $18,050 for a 128K-word 625. Deliveries will begin next month.

• HEWLETT-PACKARD AIMS FOR THE DOT with a new 180-cps matrix serial printer family that offers intelligent, bi-directional printing, automatic underlining, three standard print modes, and variable vertical line spacing. The Model 2613A printer, and Model 2635A printing terminal are the first members of the microprocessor-based family, and cost $3,150 and $3,450, respectively. First deliveries began last week.

• TEXAS INSTRUMENTS ADDS THREE NEW MEMBERS TO ITS DS990 FAMILY of disk-based minicomputers -- Models 4, 6, and 8 -- aimed at commercial end-users and OEMs. The new systems offer extensive file management capabilities that can support multiple interactive users in a multi-language environment; they are based on the Model 990/10 processor and the enhanced DX10 operating system, which is included in the package price. Software support and utilities for business applications include: COBOL, Sort/Merge, BASIC, and Business BASIC. The systems include both fixed platter and removable disks, ranging from 5MB to 50MB. Prices for the Model 4 begin at $27,400, the Model 6 at $40,600, and the Model 8 at $50,800.

• NEW XEROX COPIER PRINTS HEADS AND TAILS AUTOMATICALLY, at the rate of two impressions per second. The 9400 duplicator is essentially an upgrade on the 9200, and will produce copies on both sides of the paper. It will rent for $2,000-$2,300 a month, and sell for $85,000. An upgraded version of the 3100 copier was also announced, with a built-in 15-bin sorter. It will rent for $335-$385 a month, and sell for $17,000. The Copier King also announced purchase price cuts on some of its older machines, including the 9200.

• OLIVETTI COMMUNICATES WITH NEW TELEPRINTER, an 8-bit machine -- TC480 -- that's available in three versions: receive only (RO), keyboard send/receive (KSR), and automatic send/receive (ASR). The basic TC480 is equipped with standard DTL/TTL serial interface for local connections. Options include RS-232, Telegraphic, Passive Telegraphic, and 20MA current loop. The code is ASCII, and transmission mode is asynchronous. Optional I/O units and memory can transform the TC480 into an interactive terminal for data collection, time sharing, text editing, and batch communications. Prices begin at just under $1,700.

• HARRIS' LINE IS A NEW HIGH-SPEED CHAIN PRINTER that can reel off 1,200 lpm with high print quality. The 1654 features 132 or 136 print positions/line, six or eight lines/inch, and EBCDIC print chains in paired font combinations of 48-, 64-, and 96-character sets. Prices begin at $65,200, with five-year lease and maintenance available for $1,490/month.

• HONEYWELL HERALDS A NEW VIP, the asynchronous VIP 7200 (Visual Information Projection), a 1,920-character, dual-intensity display terminal. It is a conversational teleprinter-compatible work station for use with a variety of Honeywell minis and other systems. Purchase price is $1,980; five-year lease is $70/month.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" NOVEMBER 14, 1977 • VOL.13,NO 48 P.J.McGOVERN,PUBLISHER

Inside -- Fax delivers the mail

SMALL BUSINESS COMPUTER MARKET CONTINUES TO EXPAND AS RECENT ENTRIES BY WANG, IBM, AND NCR INTENSIFY COMPETITION

The market for small business computers is gaining momentum . . . as worldwide installed base surges over the $1 billion mark in 1977, on an installed base of above 27,000. Moreover, with over a half-million small businesses in the United States alone, worldwide installed value is expected to reach $8.7 billion by 1981, according to International Data Corporation.

Indeed, the small businessman's EDP dollar is attracting a multitude of vendors . . . mainframers, mini- and micro-makers, office equipment manufacturers, systems houses, and service bureaus. New products are being introduced almost every week, as price/performance values continue to offer users a better deal. It seems that nearly everyone capable of integrating a CRT with a CPU (mini or micro), keyboard/printer, memory (disk, diskette, or mag card), and a minimum of software, is submitting an entry.

It has, in fact, become a high-low marketplace, with a bevy of smaller companies offering entry-level systems for $5,000 to $15,000, while the more established firms continue to offer their users more capability -- and a pricetag that often falls in the $50,000 to $100,000-plus price range. Wang, which at yearend 1976 commanded about 24% of the small business marketplace, recently introduced two highly sophisticated systems -- WCS/60 and WCS/80 (based on the 2200 VS processor -- that offer virtual memory and up to 512KBs of real memory. With configuration prices beginning at about $84,000, this system is aimed more at medium-sized companies or larger firms with remote locations. Two other familiar faces in EDP and office equipment recently verified their commitments to the small business computer marketplace, with new, highly competitive product announcements. IBM enhanced its System/34, and NCR rounded out its 8000 Series by unveiling the I-8100 family.

The growth of small business computers has also been augmented by the increasing utilization of distributed processing . . . which is encouraging the introduction of small computers. Many of these machines can be used as standalone small business systems with only minor modifications. In fact, many businessmen are interested in multifunctional capabilities, particularly in communications and multitask dispersed workstations. Communications will become even more important in the future, as access to data banks and other networks becomes a crucial part of normal business.

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WHAT IS A SMALL BUSINESS COMPUTER?

Until January of 1975, when IBM introduced its System/32 and exposed yet another strata of business to potential computer use, the concept of "small business computer" was really nebulous . . . indicative primarily of the person using the term. By its very existence -- and the marketing efforts of GSD -- the S/32 has defined a marketplace that now is teeming.

And it is this marketplace IDC has in mind in its description of Small Business Computers. These are generally small general-purpose computers in the $25,000-to-$75,000 price range and with the software necessary for use in business without a sophisticated programmer. Suppliers include the mainframe manufacturers (Burroughs, IBM, NCR, Sperry Univac), independents such as Basic Four and Wang, and the minicomputer manufacturers. Often, minis used as small business computers have been programmed and are serviced by a systems house or computer service firm. Major minimakers such as DEC and Data General also offer SBCs. Specifically not included in IDC's definition are electronic accounting machines like NCR 399s or Burroughs L Series.

But despite the plethora of recent competitors, it is still the established suppliers who dominate the small business market, and likely will continue to do so for the near future. The appearance of easy market entry is deceiving, even if the system has a dazzling array of bells and whistles, and offers a good price/performance value. The first-time user market, which accounts for about 25% to 30% of the small business computer users (plus an additional 20% to 30% that are currently using electronic or electromechanical accounting machines), is both fickle and generally uninformed in EDP developments. As a result, it is likely to opt for familiar makers.

But beyond the reach of their names, the established office/EDP product manufactureres enjoy other market advantages:

- Their marketing organizations are already in place, and generally have experience in selling EDP equipment;
- Service and Maintenance outlets have been established in major cities (as a result, they can offer most users immediate service, a factor that is crucial in reassuring first-time users);
- Most offer other product lines -- upgrades from the initial system -- that help to protect users' investments;
- EDP expertise, which often implies reliability and better support capability. Complete solutions are the most important system criteria for the first-time user market.

System/34 enhanced

Although it isn't due for first shipments until January, 1978, System/34 received some new features last month from IBM's Atlanta division. The major thrust of the improvements was aimed at upgrading communications capability (with remote workstations), and at augmenting software. The impressive enhancements bolster the S/34's interactive, multifunction capability, and make it even more attractive as a part of a distributed processing network . . . it can now handle

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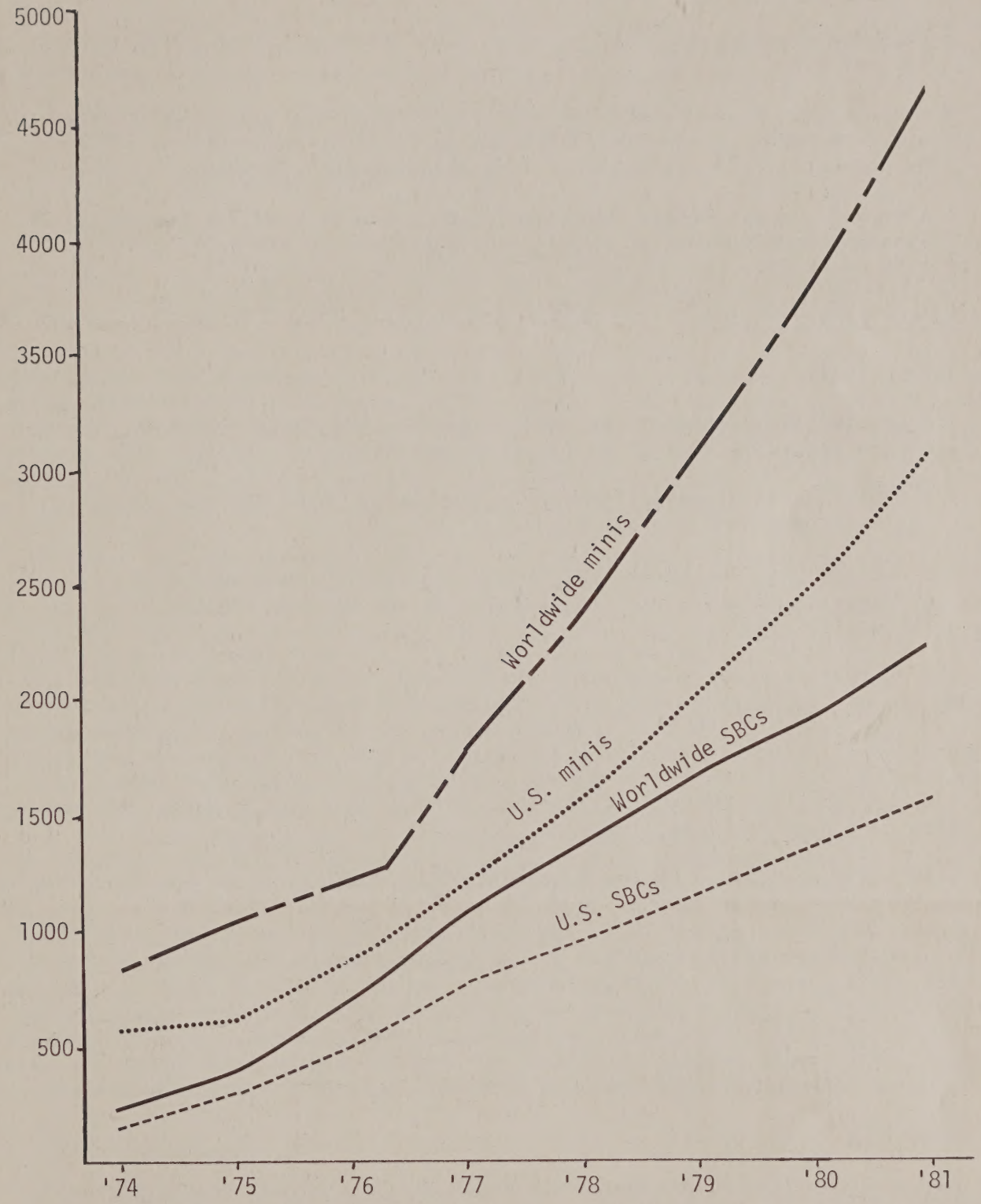
U.S. AND WORLDWIDE SHIPMENTS OF MINICOMPUTERS AND SMALL BUSINESS COMPUTERS
(by U.S.-based manufacturers -- $ value in millions)

* Note: Minicomputer figures are minus those minis incorporated into SBCs



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up to 72 stations (but with a marked strain in response time, one suspects). The additions won't be available until mid-1978 or later, but they certainly must be reassuring to potential customers . . . if a little bit nettlesome to competitors already finding competition from machines yet to be shipped. The enancements include:

On the hardware side:

+ Expanded memory capability -- up to 128KB (from previous 64KB) -- at 10¢ per byte;

+ A new workstation -- IBM 5251 Model 12 Display Station -- which can act as a remote controller, handling up to eight workstations (CRTs or printers). It communicates with the S/34 only in SDLC;

+ A second communications line adapter that can be used for intersystem communications at up to 9,600 bps (SDLC or Bisynch); cost will be $2,880.

On the software side

+ Fortran IV;

+ A Manufacturing, Accounting, and Production Information Control System (MAPICS), with 11 applications programs;

+ A Distribution Financial Accounting System II (DFAS II) for online and multiprogramming applications;

+ A Job Analysis System/34 (JAS/34), which will allow remote workstations to handle a variety of applications without dedicating the entire system.

The software announcements raise the S/34 specially-tailored applications programs to 17, although an additional 15 Industry Applications Packages from the S/32 can also be run (with some restrictions). The communications announcement is significant in that it enables the S/34 to use one line for remote workstation communication, and one for inter-system communications. More importantly, the S/34 can communicate in Bisynch with other IBM machines (using adapters), or in SDLC with 370s handling that protocol.

With the introduction of its System/32, many industry observers feel that IBM supplied the impetus for the small business market (at least defined some of its parameters). By yearend 1976, IBM held about 30% of the market; this slice was garnered solely on the strength of its batch-oriented S/32 (first installed in March, 1975), which is expected to reach close to 20,000 installations by the end of this year. The interactive, multifunction S/34, which can be configured into a single-station small business system for under $40,000, offers far more capabilities than its predecessor, without substantially raising the ante. With the IBM trademark and its DDP applicability, S/34 should dominate the market.

NCR stakes its claim

Called by William S. Anderson (NCR chairman) "one of the most important product announcements by NCR in the past decade," the I-8100 family made its debut in

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early October. Two models, the I-8130 and I-8150 were unveiled. They feature interactive COBOL 74, and can function as standalone entry-level business machines, as intelligent terminals, or as a part of a distributed processing network. They will conform to NCR's recently announced Distributed Network Architecture; NCR's Data Link Communications (DLC) and Bisynchronous Communications will also be available in the near future.

NCR has taken a low- to mid-range tack in pricing the I-8100s. Standard configurations of the I-8130 and the I-8150 can be purchased for $19,970 and $29,200, respectively. These basic systems include:

+ 48KB of MOS memory

+ Multiple processors (600 ns access)

+ Standard keyboard 9 inch (512 character) display

+ 50 lpm matrix printer

The I-8130 has dual floppy disk drives (1MB each), while the I-8150 contains a 5MB disk and a 2.5MB removable cartridge. Options abound, including a variety of matrix and band printers, 12 inch VDT, up to 64KB of memory, memory subsystem support (power failure protection), add-on disks, etc. At least 12 applications packages will be available by first quarter, 1978. These include: retail, manufacturing, health-care, wholesale-distribution, education, government, and general accounting applications (payroll, accounts receivable, etc). Following the IBM lead, all software, including operating system, is unbundled.

Perhaps the most significant aspect of the I-8100 family is its upgradability and flexibility. Several I-8100s can share files and communicate with a host CPU; all software is compatible with NCR's other I-8100 Series members (I-8200 and I-8430). Indeed, it is a small system destined to become an integral part of a larger network configuration as a user's needs expand.

The I-8100 is definitely aimed at the first-time user market. NCR has provided good documentation, training and implementation tools, simple conversion, and retail applications . . . all necessary entry-level requirements. The I-8100 will win some new customers for the firm, but its greatest success will likely come from NCR's own customer base . . . as a replacement for those aging, but ubiquitous electromechanical and electronic accounting and posting machines. Satisfying this base alone will probably keep the Buckeye mainframer working overtime for the next year.

But in addition, NCR is breaking tradition, and will be looking to systems houses and other OEMs to augment its sales. As of yearend 1976, NCR had nearly 1500 small business systems installed (I-8200s and I-8250s), and held about 7% of the installed base. The new I-8100s, which will compete with the Burroughs B-80, the Univac BC7, IBM System/32, and the single station S/34 (other I-8000 models will compete against the larger S/34 configurations), among others, will give NCR entries in most parts of the small business computer market.

The market picture

Other noteworthy competitors that have placed entries in the small business marketplace this year include:

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- Digital Equipment, whose CPUs are utilized by many systems houses in configuring small business systems, introduced the WS 78, an interactive, low-cost PDP-8A-based workstation.

- Data General, who also acts as an OEM for numerous system house configurations, is now actively looking into the end-user market with its CS/40 business system. It is also utilizing distributors such as Schweber (for its microNova) and Itel (for the CS/40).

- Burroughs introduced the B-80, and is doing well replacing its accounting machine base.

- Univac unveiled the BC7, and is actively marketing to the end-user market, including an extensive ad campaign.

- Basic Four has enhanced some of its models and expanded its line, particularly with more software offerings. It has also been advertising heavily.

Many companies entering the small business computer market have chosen to go the distributor route, simply because it obviates the necessity of establishing an extensive sales and marketing force, something which few small companies can afford. Randal Data Systems extensively utilizes distributors -- 55 presently, with plans to add 145 more next year. Diablo/Xerox, as well as a number of Japanese firms are also using this marketing technique.

The creation of computer stores may also have a marked effect on the small business marketplace, at least for the entry-level systems. The evolution of personal computers, led by Pertec, and more recently by Radio Shack will likely determine how far these retail stores progress. Support and service will also have a telling effect. But there is no question that this sales mode, as well as distributorships and OEM systems houses, will be the major outlets for small or new companies attempting to enter the small business market. In fact, the survival of these outfits will likely be linked directly to the success of the retail marketplace.

NOTE on market shares: In this as well as the Review and Forecast issue, EDP/IR by definition (see page 2) counts only the B 80 from Burroughs. The company feels its 2,375 B7XXs and perhaps its L Series accounting machines should be included.

\+ + + +

FACSIMILE USHERS IN ELECTRONIC MAIL

The rising costs of first class mail, coupled with its relatively slow speed and tenuous reliability, have made electronic mail increasingly attractive to corporations and businesses. Currently, facsimile is the primary mode of electronic mail; it provides accurate, fast, point-to-point transmission . . . of graphs, pictures, documents . . . at a cost that is rapidly decreasing, both for the actual hardware, and for the transmission costs (due to higher speed machines). Indeed, there are now facsimiles that can transmit a full page letter across the country in under 30 seconds. Other units that can accomplish this feat in four-to-six minutes can now be rented for under $30/month.

Facsimile is over a century old, and it has come a long way since Alexander Bain's electrified wire technique. Throughout the early part of this century, it

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was used mainly for transmitting weather maps and photographs (such as AP's "Wirephoto" service in the 1930s); its resolution and speed were, however, unacceptable for office use. Xerox led the way into the modern age of facsimile when it introduced the Telecopier 400 in the late 1960s. This machine, and the updated, unattended version which followed it, the Telecopier 410, account for most of Xerox's dominant 50% facsimile market share (in number of units).

The marketplace

There are currently about 145,000 facsimile units in the United States, including some 25,000-30,000 specialized and older units (weather chart transmitters, etc.), according to Howard Anderson, of Boston's Yankee Group. This figure is expected to reach nearly 250,000 by the turn of the decade. Presently, the facsimile market is expanding in two directions -- low-cost, low-speed (four-six minute) convenience units, and higher cost, high-speed machines. The former units are manufactured by Xerox, Graphic Sciences, and 3M (all of whom also make two-minute devices), and a newcomer called Qwip.

Qwip is a subsidiary of Exxon, and in its three-odd year existence, it has managed to capture over 10% of the overall fax market with its $29/month device that has a repair-by-replacement maintenance policy. That price is less than half that of its closest competitor, and by early next year, Qwip will introduce a two-minute model for about $60, as well as an unattended version. Like the rest of the fax makers, most of Qwip's units are rented, but it also boasts a 500 person sales force.

The high-speed market is currently dominated by Rapifax, a subsidiary of Ricoh, a large Japanese concern (also responsible for a number of U.S. copiers). Until recently, when 3M announced its Express 9600, Rapifax had the high-speed market all to itself (about 3,000 units) in the U.S. The Rapifax Model 100 transmits a page in under 35 seconds, costs about $10,000, or rents for $300/month. The new 3M 9600 is slighly faster, has full duplex, and sells for about the same price. It is the Rapifax machine, however, that will take part in Satellite Business Systems' (SBS) Project Prelude, an experiment that will explore applications of satellite communications. The Rapifax will be used to transmit documents at 19K-bits/sec, which will result in document transmission of about 20 sec/page.

Indeed, SBS will play a major role in promoting the utilization of facsimile, both because of higher speed (eventually it should reach 56K-bits/sec) transmission, and communications costs savings. Other digital networks, as well as message and packet switching, store-and-forward service, and value-added networks should enhance facsimile's appeal to users.

New ideas

Some of the latest innovations in facsimile include Stewart-Warner's hybrid machine, called the Datafax Dimension. It combines facsimile technique (essentially dot reading) with Optical Character Recognition (OCR), and can thus supply input directly to computers. This allows fax to be faster and more versatile, and if the technology pans out, it will likely be the product direction of the future. The Japanese, whose fax technology is somewhat ahead of the U.S., have a number of manufacturers producing high-speed machines; they are currently developing facsimile switching networks throughout the country. These will include store-and-forward, as well as data manipulation. Fujitsu, NEC, Matsushita, NEC, and Toshiba, all plan to begin U.S. marketing efforts in the near future.

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• DEC EXPANDS ITS LSI-11 FAMILY with the LSI-11/2 microcomputer, that includes 16K MOS RAMs, as well as 4K components. Scheduled for deliveries in March, 1978, the new micro offers access and cycle times of 250 ns and 570 ns, respectively. The price of a typical 32-word two-card LSI-11/2 system (CPU and memory) is $1,643 in 50-to-100 quantities; this represents a 55% savings over DEC's current CPU/memory board price for the same configuration. The LSI-11/2 will take on other 16-bit microcomputer competitors, including Zilog, Intel, Data General, and TI.

• HONEYWELL TAKES THE DISTRIBUTED ROUTE, WITH A NEW LEVEL 68 DPS COMPUTER that is a single model, available in four sizes. The new machine, which will replace two large systems, Models 68/80 and 68/60, will operate at least 15% faster than its predecessors, and cost less than half as much, although Honeywell will be charging for all software beyond the operating system. The air-cooled 68 DPS will run on Honeywell's Multics software, and will be compatible with other Level 68 systems. With special adapters, Multics systems can also operate in a GCOS (Honeywell software for Level 66 systems) environment. The Multics operating system is virtual and interactive, and is thus ideal for a distributed processing environment.

The DPS is designed to compete with all of IBM's recently announced 303X processors, including the 3033. A basic 68 DPS configuration consists of 512K words (approximately 2MB), internal communications processor, and console. In this configuration, the Model 1 sells for $1.26 million, and offers 25% better performance than the 3031, according to Honeywell. Models 2, 3, and 4 offer additional processing capacity, and cost $1.78 million, $2.35 million, and $2.91 million, respectively, in standard configurations. All can be expanded to 4 "megawords" (roughly 16MB), for the equivalent of $110,000/MB. The Model 4 can accommodate two companion processors (for $474,000 each) to give it about 23% greater performance than the 3033. The 68 DPS will be available in the second quarter of 1978.

• TEXAS INSTRUMENTS HAS TAKEN TO THE POLLS with its Model 704/1 Terminal Polling System (TPS) that stores data in an IBM-compatible format. The new machine can collect and store data from up to 200 Model 770 Intelligent Terminals or Silent 700s. The 704/1 TPS consists of a Model 990 mini with 48KB of RAM, a tape drive, and a Silent 700 data terminal; it can accommodate up to four telephone lines. The base purchase price is $13,000, with deliveries beginning in January, 1978.

• HARRIS UNVEILS ANOTHER DDP SYSTEM -- the 1670 Distributed Processing System, that includes a new 3270-compatible terminal. The 1670 is compatible with all other 1600 family members, and can handle local and remote, batch and interactive applications simultaneously. Hardware includes up to 98KB of 750 ns main memory, up to 96MBs of disk, and a 28 CRT capacity; there are a number of communications interfaces and a variety of software packages that can support remote communications with IBM, Univac, Honeywell, Control Data, Burroughs, and Amdahl mainframes. A typical 1670 configuration with 82KB of memory, four switchable and four non-switchable terminals, 6MBs of disk, and 300 lpm printer sells for about $109,600, and will be available in February, 1978.

• ABRACADABRA, TEKTRONIX CRT TURNS ALPHNUMERICS TO GRAPHICS, using a data storage technique called "virtual bit map," in which alphanumerics and graphics are referenced in the same display list, but stored separately in ROM, and RAM respectively. The Model 4025 is the first raster CRT to perform this integration. It also provides an RS-232 full-duplex interface. The 4025 is currently available, and costs $3,595 ($3,307 in OEM quantities).

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" ~~OCTOBER~~ NOVEMBER 22, 1977 • VOL.13,NO.~~8~~ 9 P.J.McGOVERN,PUBLISHER

Inside -- New CPUs from Burroughs & Univac

COMPUTERS IN U.S. GOVERNMENT TO TOP 10,000 IN FY 1977 AS INSTALLED VALUE EDGES TOWARD $5 BILLION MARK

The U.S. government continues to augment its EDP stockpile. By the end of FY 1976, (ended June 30, 1976), the U.S. government's installed base of computers reached 9,650 . . . a healthy 11.5% increase over the FY 1975 total. (This figure, and all other numbers relating to the value or installed base of computers in the U.S. government, are derived from the General Services Administration's [GSA] FY 1976 *Inventory of Automatic Data Processing Equipment In The U.S. Government.)* Indeed, preliminary indications are that this year's accounting will reveal nearly 11,000 taxpayer-financed computers in federal installations.

Moreover, the FY 1976 installed value of computers in the U.S. government reached $4.41 billion, a 9% increase over the previous year; indications are that this figure should hover around the $4.8 billion mark for FY 1977, as the government moves to increase its networking capacity, and to update some of its older machines.

Based on an IDC study of U.S. government EDP, and on an analysis of GSA data, the following conclusions about government EDP have been drawn; computers in the federal government are:

1) growing in number at only a 10%-11% clip, which means they are rapidly decreasing (over 10% annually) in number relative to the total U.S. installed base;

2) growing in installed value at an 8%-9% rate, which means that the government's installed value is slowly (less than 1% annually) decreasing relative to the total U.S. installed value;

3) increasing in number faster than in value in the special management* classification, although both number and value are rapidly decreasing relative to the total U.S. pace;

4) increasing in value faster than in number in the general management* classification, while maintaining, or increasing both installed value and number relative to the total U.S. pace;

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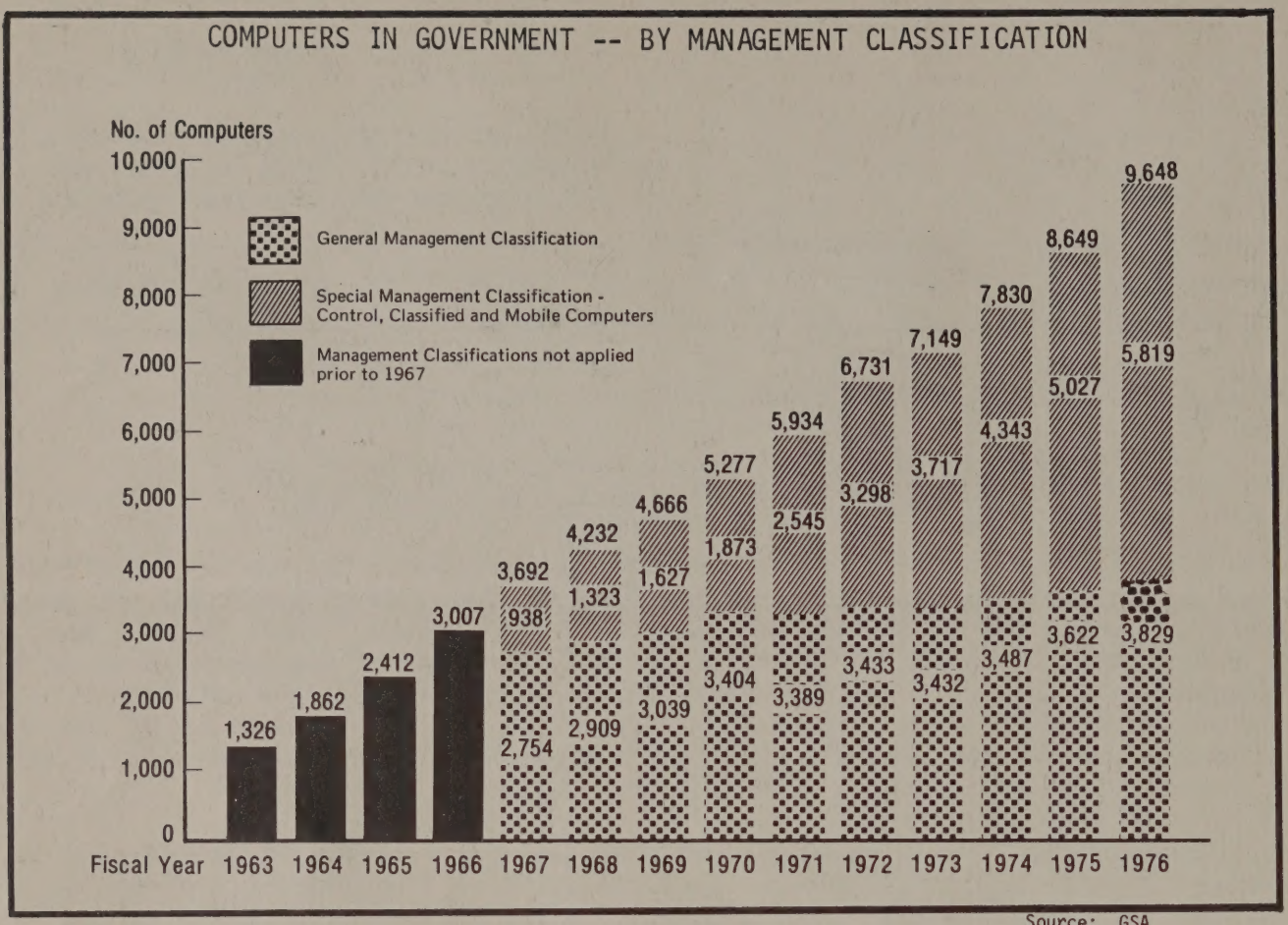

5) increasingly being purchased (as opposed to leased) -- 78% and 97%, in general management and special management, respectively, in FY 1976.

**Note: The GSA's definition of special management computers includes: minicomputers, dedicated application computers, and "all other computer-based systems used in various operational environments." This definition is roughly equivalent to IDC's "minicomputer/ dedicated application" classification.*

The GSA's definition of general management computers is basically equivalent to IDC's "general-purpose" classification.

The government has had a long, comfortable relationship with computers . . . it owned the first Eniac back in the early 1950s; and throughout that decade, Uncle Sam subsidized the fledgling computer industry by purchasing nearly all of the early, building-sized collections of vacuum tubes, cables, casings, whistles, and bells. Government prognosticators obviously foresaw the day when sophisticated electronic devices would be an absolute necessity for running the complex, multi-faceted Affairs of State. And in fact, the U.S. governemnt is still the largest single computer user in the world . . . these black boxes have now become an integral part of its burgeoning bureacracy. Agencies throughout the federal government, from ERDA to the Defense Department, are totally dependent on computers to control their information flow.

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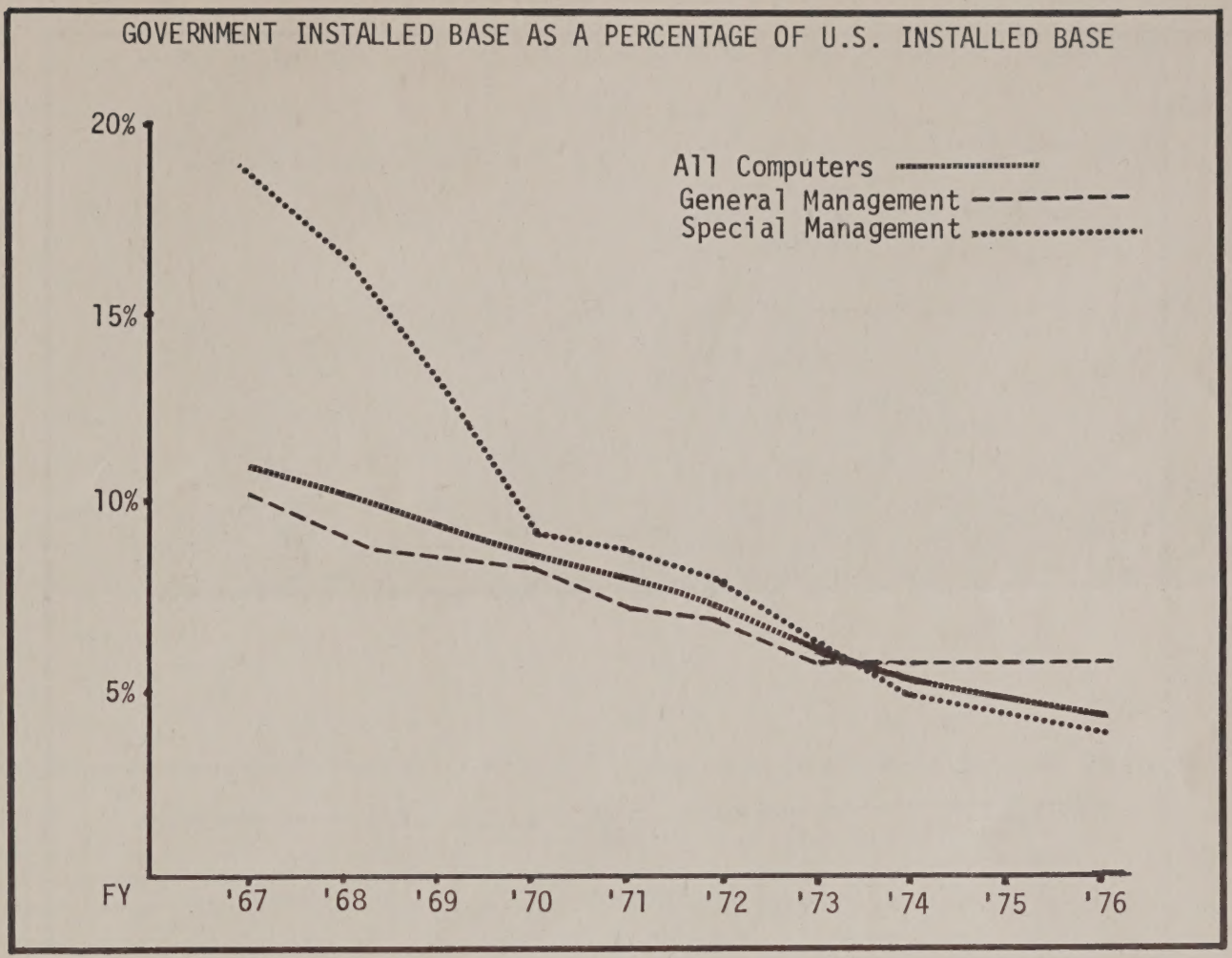

Of mainframes and minis

The statistics behind the government's FY 1976 acquisitions show a 16% increase in the number of special managment computers, to 5,819, and a 5.5% growth in the number of general management computers, to 3,829. The government's installed base (unit) growth rate of 11.5% was still less than half of the total computer industry growth rate (in terms of number installed) . . . the latter being fueled primarily by the 32% growth in the number of minicomputers, which made up over 70% of the U.S. installed base in 1976. However, the government's 9% increase in installed value (for all computers) was just slightly below that of the total U.S. pace.

Perhaps the most significant statistic is the government's 5.5% growth in the number of general management computers installed -- its highest since the late 1960s -- which easily outpaced the total U.S. general purpose industry's actual 1% drop in units installed. In addition, the government's installed value of general management computers climbed over 10% in FY 1976, to $3.18 billion. Therefore, the $290 million net that the government spent on general management computers last year resulted in a net increase of only 200 computers . . . indicating that the price/system was nearly $1.5 million. The value of mainframes is thus increasing relative to their number, attesting to the government's propensity toward centralization -- and thus dependence on larger, more powerful (and more expensive) computer systems. While upgrading, the government is mothballing some of the old

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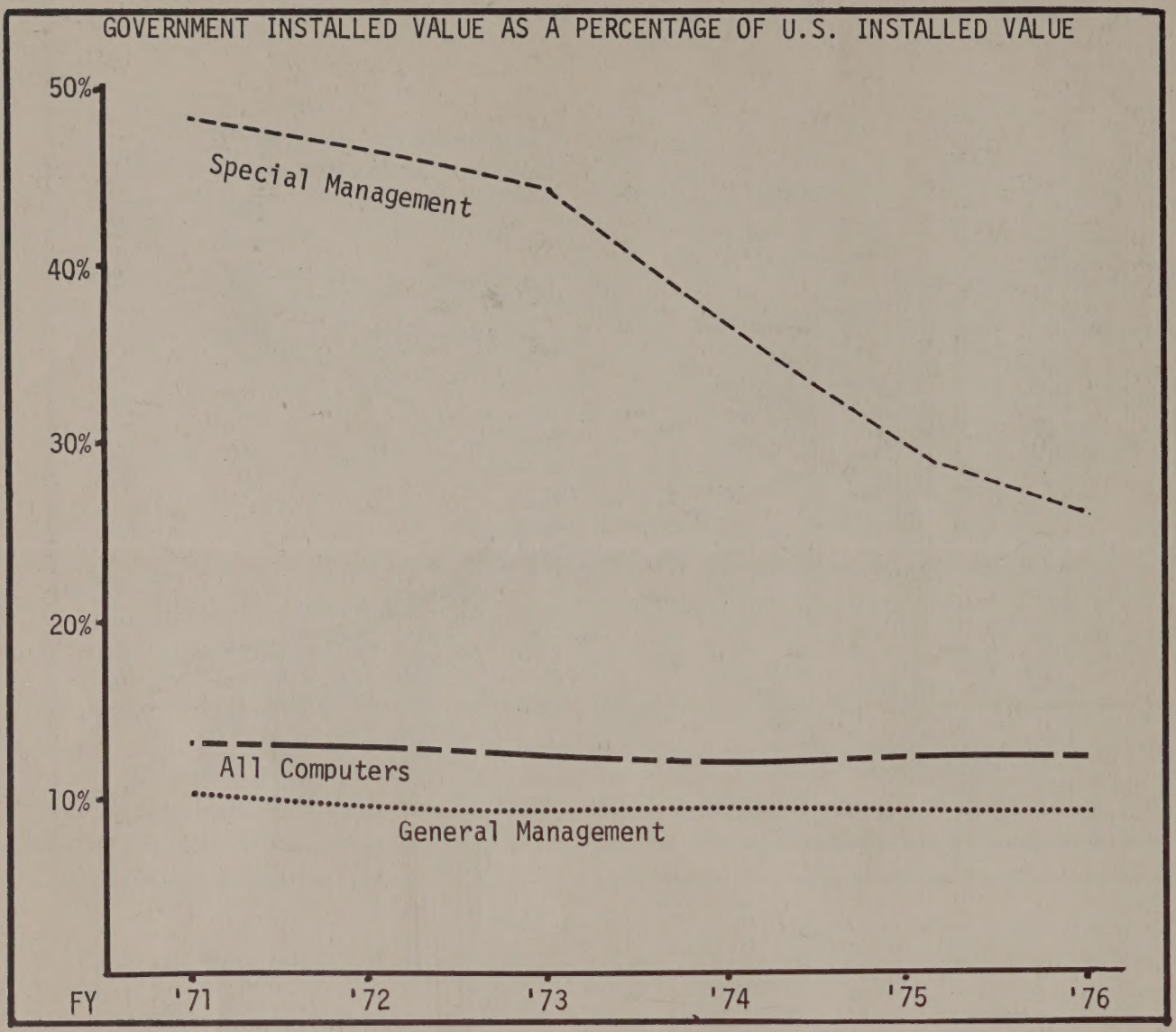

clunkers that have been around since the early 1960s. This trend is further verified by the fact that in FY 1976, the government added a total of $560 million in new equipment, but the net increase in installed value stood at $360 million.

While general management computers in the government held less than 40% of the FY 1976 installed base, they continued to dominate in installed value, with over 72%. The government still held over 9% of the U.S. installed value of general purpose computers, and 6% of the U.S. installed base . . . further illustration that the government spends more per computer than the average user. Indeed, with just under four percent of the U.S. installed base of all computers in FY 1976 (down from 8.4% in 1970), the government continued to account for 11% of the installed value (down from 13% in 1970).

The special management picture

The price/machine discrepency (with other U.S. users) is even more egregious in the special management classification, where the government held just over 3.8% of the FY 1976 U.S. installed base (down from 9.2% in 1970), but still managed

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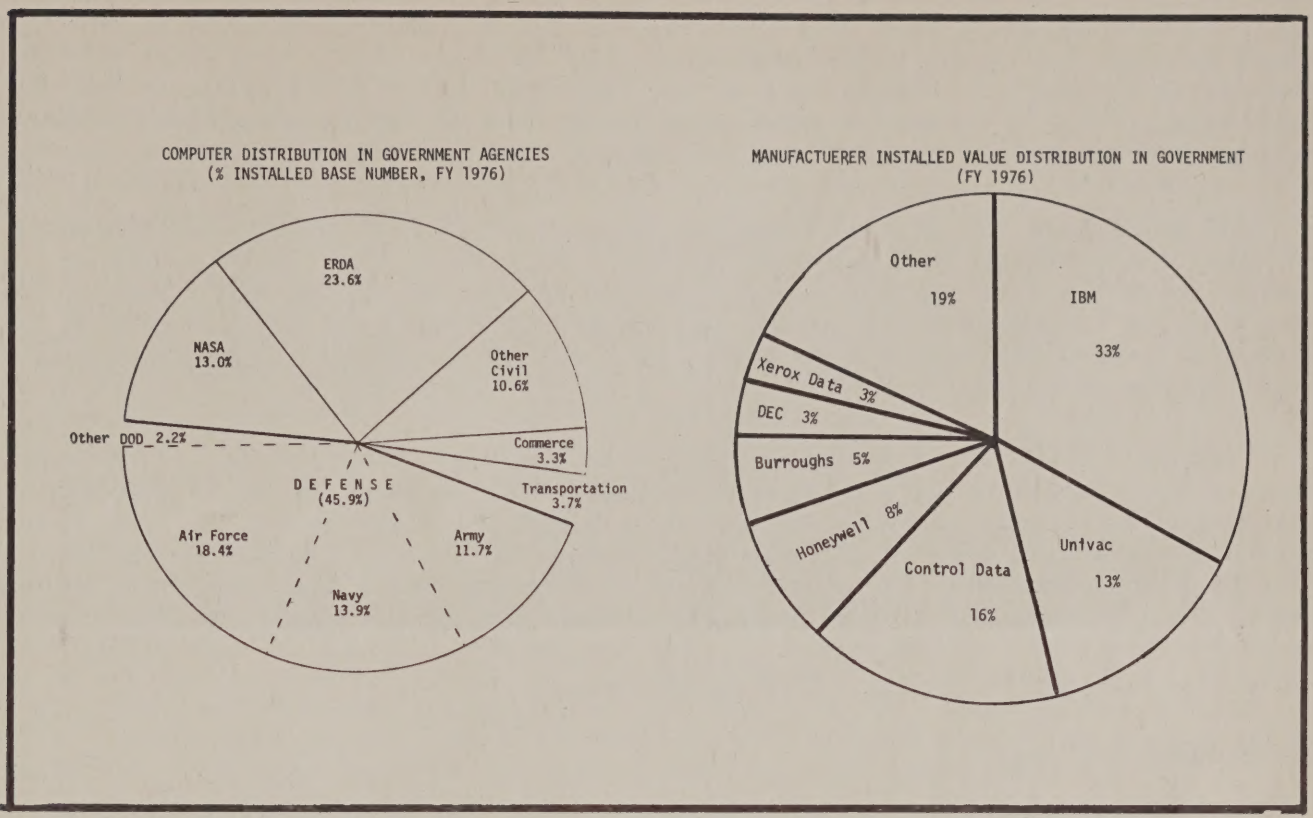

over 26% of the U.S. installed value (down from 48% in 1971). This significant differential again reflects the government's high cost/machine. In addition, the government, which has always been one of the first to take advantage of new developments in the EDP industry, was one of the original users of minicomputers and communications terminals. In fact, in 1971, special management computers had already managed a 43% share of the total computers in government, and by 1976 had grown to 60%; this percentage shift is expected to continue, but at a slower pace than for the rest of the U.S. users. The government, due to its centralized nature, will continue to acquire general management computers while maintaining and upgrading its present inventory.

As a result of the government's early acquisition of special management computers, it still possesses a plethora of aging machines that are quite expensive relative to today's price/performance standards . . . which have been increasing exponentially over the past six years, particularly in smaller systems. Moreover, it may be difficult for the government to retire much of this equipment because over 89% of the special management equipment was purchased in 1971; this figure had increased to 97% purchased in FY 1976.

But the newer special management computers in government are becoming less costly. While FY 1976 installed base climbed 16%, installed value increased less than 7%. A similar situation has existed during the past three fiscal years. In 1975, for instance, special management installed base also increased 16%, while installed value moved up less than 5%, another indication that it's the antiquated, machines that are at least partially responsible for buoying up the installed value.

Vendors in government

The U.S. government is a vendor favorite, because most of its equipment acquisitions are by purchase . . . a distinct advantage for short-term cash flow. In

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addition, manufacturers must competitively bid for a number of contracts, and this allows many of the lesser known computer makers to place their systems in government installations . . . while much of the "outside" world still tends to buy the "name brands." As a result of this competition, the distribution of manufacturers' equipment in government is more evenly divided.

IBM still held 33% of the installed value as of FY 1976 (with $1.4 billion), but this is significantly lower than its 65% U.S. market share in 1976, and a drastic reduction from the 75% share it had in government in the early 1960s. In fact, some of the Giant's current share undoubtedly dates back to that period. Control Data held 16%, and Sperry Univac held 13% of the FY 1976 installed value of government computers.

With over 2,000 CPU's installed, Digital Equipment outdistanced its closest competitors, IBM and Univac, by nearly double. The Armonk mainframer, however, took honors in storage units, with just over 8,000 installed (about 17%), followed by Control Data with 6,000. IBM also held 22% of the 55,000 I/O units installed as of FY 1976, distantly followed by Univac and Control Data with about 10% apiece. Control Data managed 22% of the installed communications terminals, followed by Honeywell with 16%, and IBM with 11%. IBM equipment accounted for 65% of the "miscellaneous" EDP stock installed in government.

Software and Services

Hardware acquisition represents only a part of the government EDP spending. According to a recent General Accounting Office (GAO) report, the federal government spends nearly $6 billion annually on software. The GAO estimated that $3 billion of this figure is used for maintaining and converting programs. Another chunk, $425 million is utilized for software conversion costs when agencies replace one computer system with another, while more than $25 million is spent on outside program conversion. The remainder is spent on a variety of new packages and on developmental costs. The federal government is particularly interested in developing more on-line systems, and this new mode requires extensive reprogramming of its batch-oriented systems.

The federal government also depends on service bureaus to handle some of its EDP. The government was responsible for over 45% of the user spending for facilities management services in 1976 -- to the tune of $225 million. This figure represented 11% growth over 1975, and the trend is expected to continue, as government spending on facilities management reaches $385 million by 1981 (according to IDC estimates), although its share will fall to 39%.

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NEW LARGE-SCALE SYSTEMS FROM BURROUGHS AND UNIVAC ENLIVEN MAINFRAME COMPETITION

The succession of announcements following IBM's unveiling of its 3031 and 3032 continues . . . as Sperry Univac and Burroughs augmented their top-of-line systems. Univac unveiled five new machines, two in its byte-oriented 90/80 family, and three in its word-based 1100 Series; the systems offer price/performance challenges to IBM systems in the 148 and above range (including the 3031, 3032, and 3033). Burroughs' latest hardware is a multiprocessor-based addition to the B 6800 Series -- the B 6817 -- that hovers in the price range of the 3031.

The B 6817 offers 50% greater throughput than the B 6811, and 50% more computing power than the entry-level B 6803. It is object-code compatible with all

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B 6800 and B 7000 systems, and handles interactive APL, Cobol, Algol, Fortran, PL/1 and Basic. The system merges well with Burroughs' Data Management and Message Control Systems, enabling it to perform in on-line networks. The Burroughs Master Control Program (MCP) manages the entire system, which can be operated in either a multiprocessor or shared resources (CPUs independent, but data shared) move.

A basic B6817 consists of two 6.67MHz CPUs, two I/O processors with a minimum of 20 channels each, two maintenance processors and displays, and two operator consoles with dual displays. The system can accommodate up to 4 CPUs, 16 datacomm processors (serving over 4,000 lines), and up to 15.36MBs of directly addressable memory. The new machine, although competitive with the 3031, will likely provide primarily an upgrade path for B 6800 users . . . but it may attract uncommitted users accross the line. As of yearend 1976, Burroughs held just under 10% of the installed value of Class 5 computers (the 370/148 class).

Despite some losses of key people in its top management ranks during the past two years (including C.E. Exley to NCR), the Motown Mainframer has had an excellent year in 1977. Third quarter sales and earnings climbed to record levels, as did the nine-month (ending Sept. 30) figures. Worldwide backlog has risen 28% since January, as Burroughs has added a number of new machines to its lineup, including the prodigious 7800, and many smaller systems. The firm has also repriced its systems in line with industry reductions. With its virtual machines and a crack operating system (MCP) to run them, Burroughs' customers are likely to continue their loyalty -- 93% according to EDP/IR, Jan.21, 1977.

Sperry Univac on the move

Sperry Univac's announcement was a blockbuster . . . one of the more noteable responses to the 303X. Continuing down the path bifurcated when it took over RCA's base in 1971, the firm announced the five new computers mentioned above. One of them, the 1100/84, allegedly tops IBM's 3033 in power to rival that of Amdahl's V7. In a 4-processor configuration with 2,000K words of memory, 32K-word cache, and twelve channels, it costs just over $4.6 million. Univac rates the 1100/84 at 4 times the power of an 1100/81. Also announced were the 1100/80 (70% of the power of an 1100/81, pricetag over $1.2 million) and the 1100/83 (3 times the power of an 1100/81, pricetag of $3.7 million). Memory in the 1100/80 series now runs from 524K words (2MB) to 4,192K words (16MB).

For RCA decendants, Sperry introduced the 90/80-2 -- supposedly 140% as powerful as a 370/148 at 93% of the price -- and the 90/80-3, equivalent in performance to the original 90/80 but repriced downward to compete with the 3031. The purchase prices for these systems range from $780,000 to $1.2 million. (And a 90/80-4 will be introduced later, said a Sperry spokesman, primarily to compete with the IBM 3031 on more of a one-to-one basis.) The company also announced a disk drive competitive with IBM's 3350 and some special purpose system modules -- one for the speedier arithmetic handling, one for better intra-unit communications control -- for the 1100/80s.

With this latest announcement, Sperry Univac -- which boasts a 14.5% slice of the Size Class 7 pie by value, 5.3% of Size Class 6, and 7.1% of Size Class 5 -- made a fairly strong statement about its committment in this latest of mainframe price/performance slugfests. Its use of 16-bit chips in the new CPUs, as well as ECL circuitry, and a souped-up VS operating System (VS 9) . . . indicates the firm is no slouch when it comes to technology. One interesting note: System software is still bundled.

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• DIGITAL EQUIPMENT DECKS THE PRICES ON PDP-11 SYSTEMS, cropping them 8%-21% on eight of its PDP-11 packages. Productivity gains, cheaper raw materials, better manufacturing capacity, and intensified competition are some of the reasons for the downward revisions. Included are: the PDP-11/03, -11/04, -11/34, -11/60, and -11/70. For instance, a PDP-11/34 system with 64KB of MOS, 5.9MB of disk drive, 2.6MB disk system, akd RT-11 operating system, will now sell for about $27,500.

• IBM, NCR, AND BURROUGHS CUT NEW RECORDS ON QUARTERLY EARNINGS AND INCOME. IBM profits hit $690 million, on revenues of $4.59 billion, a 17.6% and 15.9% increase, respectively, over the same period last year. At Burroughs, earnings rose 16%, to $43.2 million, on reveunes of $490 million (an 11% increase). Earnings at NCR jumped 33% over last year's quarter, reaching $33.3 million, on revenues of $604 million. IBM and Burroughs pointed to record sales, while NCR noted improvements in service and equipment margins. HIS also reported an excellent quarter.

• HONEYWELL DIPS INTO ITS COFFERS TO PURCHASE INCOTERM in a stock conversion arrangement worth about $40 million. Under the proposed arrangement, Incoterm, an intelligent terminal maker with sales of about $40 million in 1976, would become a division of HIS-U.S., with its high-ranking officers continuing to manage its affairs. Last year, Data General failed in its attempt to acquire Incoterm. Honeywell should be able to provide Incoterm's products with the market clout they need to compete against the larger terminal makers; for its part, Incoterm will be an asset to Honeywell's DDP ambitions -- if the Justice Department doesn't intervene to nix the deal.

• DATAPOINT IS ON THE LINE WITH INFOSWITCH/SHARE, a telephone communications management system aimed at companies with remote offices who want intelligent switching and line metering. A SHARE system with one Datapoint CPU, and two 6-trunk, LDCSs (Long Distance Control Systems) can be purchased for about $86,000. An Automatic Call Distributor (ACD) was also announced. In addition, Datapoint has added the 1500 Dispersed Processor to its line of DDP products. The dual-floppy system comes with a keyboard, screen, and built-in communications capability, and can operate as a standalone or in conjunction with a central computer, with prices beginning at under $6,000.

• NAKED MINI TO BE EXPOSED IN RETAIL STORES, according to an agreement between Computer Automation and Tandy Corp.'s recently organized Computer Division. The CA minis will be sold over-the-counter in small business-oriented systems packaged by Tandy, and as standalone processors for professionals and hobbyists to integrate into their own systems.

• HARRIS IS IN THE NEWS WITH A NEW FAMILY OF COPY PROCESSING SYSTEMS that provide advanced editorial, classified, display, and business data processing capabilities. The five new systems are part of the Harris 2530 Series, and are aimed at smaller newspapers, with prices up to 40% below the firm's larger systems. The lower pricing is primarily the result of standard product "packages" developed for each 2530 model; this allows for better amortization of software development costs. In addition, there are pass-through hardware savings on the DEC minis that are used in the systems. The 2530s feature large data bases, back-up facilities, high-speed wire line handling, and advanced editorial terminal capabilities. One model, the 2539, performs general-purpose business data processing, and serves as a back-up system. A typical, ready-to-plug-in system begins at about $250,000, and is currently available.

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"THE GRAY SHEET" DECEMBER 5, 1977 • VOL.13,NO.10 P.J.McGOVERN,PUBLISHER

Resource sharing at hand

DATAPOINT UNVEILS AN "ATTACHED RESOURCE COMPUTER" (ARC) AS DDP VENDORS SEARCH FOR WAYS TO IMPLEMENT RESOURCE SHARING

The Distributed Data Processing concept has stepped into a new dimension. In the past two weeks, three major contenders in the DDP marketplace -- Sycor, Datapoint, and Hewlett-Packard -- have introduced "links" that enable "transparent" communications between terminals (or other processors) within the same building. The links consist of both hardware and software advances, and the significant result of these innovations is that true resource-sharing among processors (sans protocols or host front-end shunts or media switching) can now be realized. Indeed, dispersed processing (and distinct applications) with shared data bases has always been the underlying principle behind DDP's potential . . .

Of the three introductions, Datapoint's is the most extensive, and offers the most far-reaching ramifications. Since ARC's introduction last week, the firm has been whistling "This could be the start of something big," claiming that "ARC is the most important development in data processing since the minicomputer." Whether these boasts are mere marketing ploys or grounded in fact, remains to be seen; regardless, it is the users who will ultimately decide whether the firm is whistling in the dark or heading for Broadway.

The ARC system is basically an ingenious way of stringing Datapoint processors into a network that appears to be one huge computer (as far as data access is concerned); yet each processor retains its dedicated applications integrity. ARC's main ingredients include:

- A coaxial cable that takes advantage of cable TV technology to shuttle data back and forth at 2.5 megabits/sec, and junction boxes/amplifiers, called "Hubs," that act as nodal connections.

- Resource Interface Modules, acronymed RIMS (to go with hubs?) that provide a unique address for each processor on the cable and act like mini packet switchers to enable high-speed data transfer.

- The attached processors themselves, which can be of two varieties -- File processors (Datapoint 6600 or 5500 with hard disk), or Applications processors, which are the engines for each of the various data processing applications.

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- All previous Datapoint software, including Datashare and Datalink network programs, high level languages, etc.

A network of molehills

Datapoint's concept is relatively simple . . . by splitting the functions of a computer system into smaller bites (as it were), it's easier for the overall system to run efficiently. Economies can also be realized through shared peripherals (such as one fast printer for three or four applications) and shared memory banks. Security and downtime protection are also enhanced. Since file processors are dedicated strictly to file handling and disk maintenance, they can provide data at faster rates than any individual processor that's also trying to run programs. Applications processors are thus relieved of all overhead duties related to processing their applications programs. The sophistication of the system lies in the coaxial bus and RIMs that allow data transfers to appear transparent . . . and the operating software that allows all previous Datapoint software to run in the ARC system.

From a Datapoint user's view, ARC provides an upward growth path of exceptional simplicity. From a non-Datapointer's view, however, ARC implementation requires some judicious splitting of functions and databases to cost justify its implementation. "Assigning each particular system component a specialized task is important," says the firm, "inasmuch as it allows for the functional dispersion of tasks, and for faster overall system operations."

To make such functional dispersions more palatable (and more attractive to traditional DP users), ARC allows the attachment of an IBM 360/370 (or Amdahl, Itel, or CDC Omega) to the ARC bus as another applications processor. Connection is via a 6600-based front end with appropriate RIM and software modules. To the IBM box, the ARC system appears as a unit record machine (actually as up to eight unit record machines) connected through the byte multiplexor channel. Data rates are not limited to unit record device speeds, however, since the byte mux channel can ingest data much faster. On the other hand, to the ARC system, the mainframe appears to be anywhere from one-to-eight applications processors.

Catching the bus

The ARC system configuration is relatively simple -- up to 255 processors can be hitched to any one bus. Each processor must have a RIM, and each RIM connects to a hub. (A passive hub can connect up to four RIMs, while an active hub can link up to eight -- sixteen optionally -- RIMs or other active hubs). Cable lengths between hubs and RIMs or other hubs may reach 2,000 feet; and since up to ten hubs can be connected in tandem, the total cable length can reach up to four miles.

Processors attached to the bus depend on the user's workload and applications mix. There are no limits (other than the user's practical ones) on the amount of disk that can be attached to the bus, nor is there any set ratio of applications processors/file required. Contention for the data stored on disk, however, will probably mandate a certain optimal mix.

Applications processors can run the gamut from a small Datapoint diskette unit to an IBM mainframe, and their applications can vary considerably . . . from telecommunications off of a Datapoint 6600, to print spooling off of a Datapoint 3800 (new processor). To the applications processors, all files on the file processors appear as if they are directly on the application processor.

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Files may also be kept locally at the applications processor for security reasons; these files cannot be accessed by the ARC system. Hence a mainframe can access ARC system common files, but other ARC processors cannot access the mainframe's files (unless they are routed into the system).

ARC systems can be connected through file processors (any FP can be connected to a maximum of six ARC systems) or through telecommunications via applications processors. In fact, Datapoint notes, users may want to utilize an ARC system to implement telecommunications with their hosts, since there would be no software overhead draining the host.

Two new systems and a front end

To complement its new ARC system, Datapoint also introduced two new processor series' -- 3800 and 6000 -- and a Direct Channel Interface option (DCIO). The 3800 series consists of two models, a 60KB and a 120KB, both of which are single-user machines, and can be used only as applications processors. They have built-in RIM, VDT/keyboard, and special function keys. Software includes COBOL, BASIC, RPG, Databus, and Dataform; all 3800 programs can be handled by other applications processors on the bus. Synchronous or asynchronous communications are supported. The 120KB processor costs $10,790, while the 60KB sells for $6,950.

The 6000 Series is a variation of Datapoint's 6600 Advanced Business Processor. It also is available in 60KB and 120KB versions, and features 600 ns memory cycle time, multiple-byte I/O transfers, and a built-in program loader. The 60KB model can support up to 16 CRT terminals, while the larger model can handle 24. The 6000 series can also support up to 200MBs of disk, as well as Datalink, Datashare, and all 3800 software. The 60KB model sells for $11,616, the 120KB for $15,216.

The DCIO allows a 6000 series Attached Processor with RIM to be connected to the byte multiplexor channel on an IBM 360/370 computer. The DCIO can be interfaced without any modification of either the ARC system or the host operating software. Data transfer from an ARC common database is always initiated by the IBM (or other IBM plug-compatible) mainframe. Indeed, with the DCIO, the IBM host can partition up to eight applications programs running simultaneously (and in full duplex mode) off the ARC database. Data transfer is transparent to the host operating system. The DCIO sells for $22,908, but a three-year lease is also available. Both new processors and DCIO will be available in the summer of 1978.

Implications of ARC

Despite all the hoopla, ARC will initially be used to satisfy current Datapoint user demands for more processing power and database support. These first applications will likely be simple linkages of ongoing Datapoint systems for redundancy and data sharing. There are however, some longer range considerations:

- Datapoint has targeted the automated office as a primary marketplace, and some better word processing software and output capability (the firm already has one WP package called SCRIBE) should make ARC more attractive to today's office managers.

- The electronic mail applications are intriguing. For one thing, Datapoint's Infoswitch can link to ARC as another applications processor . . . meaning store-and-forward message-switching applications would be relatively easy to implement.

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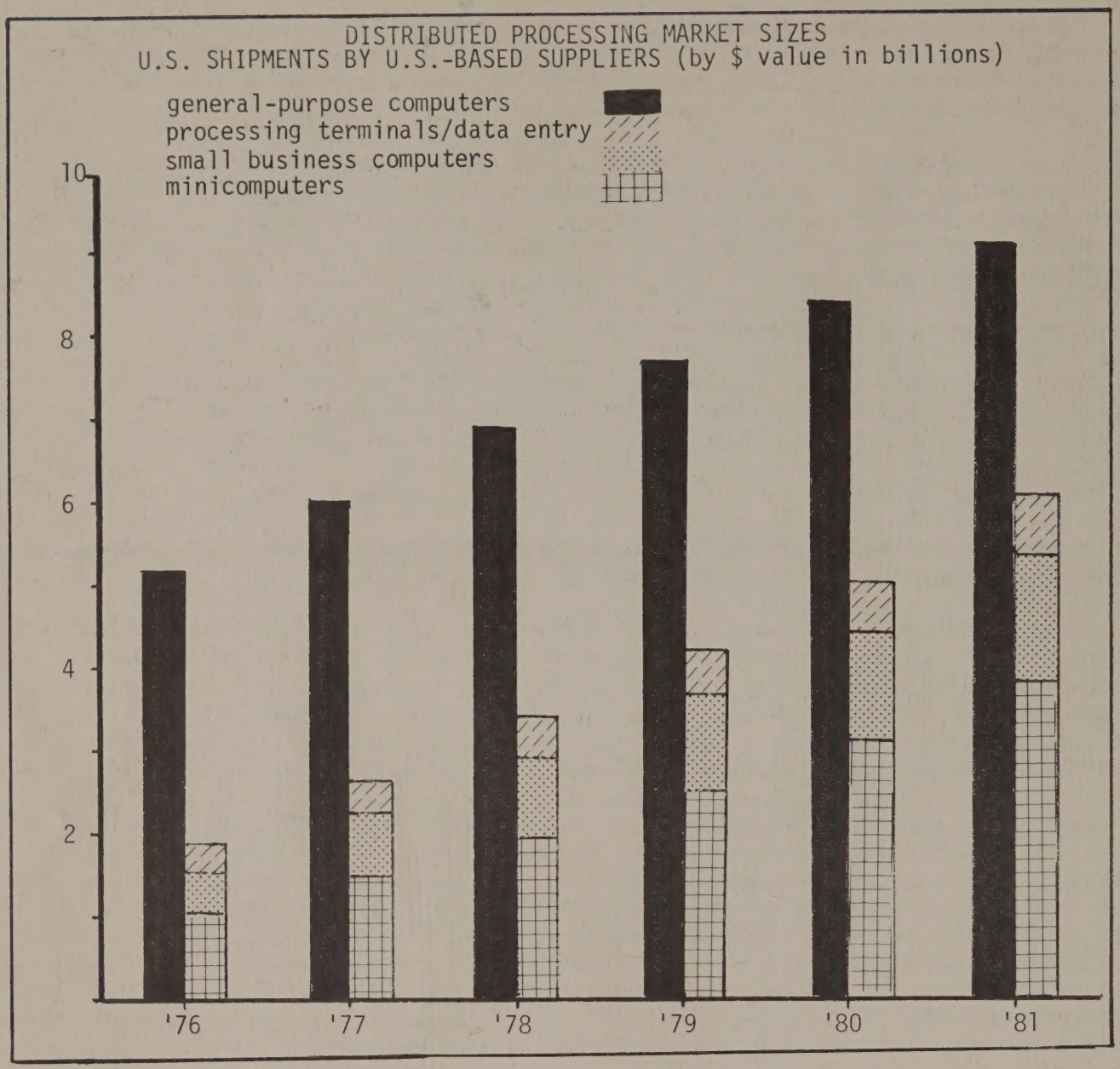

- The mainframe upgrade market looks promising, notes Datapoint . . . in other words, the ARC system could replace a larger mainframe and/or all of that telecomm software and hardware that accompanies it.

- Resource-sharing appears to be coming of age, and the applications to commercial data processing have broad implications.

Thus far, the greatest drawback to ARC seems to be that it requires users to be knowledgable enough to designate their particular DP functions and databases . . . and to control the operation, which is perhaps the highest single hurdle a DDP implementor must face. One can also envision problems in untrammelled hardware proliferation . . . much in the same way that minicomputers have overpopulated some organizations. Datapoint assuages these trepidations by asserting that ARC actually delegates more control of the distributed net to central DP, and that the system alleviates upgrade headaches. "But yes," said one marketing type at the announcement, "there'll have to be some systems design and configurations worked out."

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For now, ARC is as much concept as cable. Though it's doubtful that anything with so much self-pomp and pretense could rival the importance of the minicomputer (which as EDP/IR recalls, came upon us with little fanfare), it is undoubtedly a significant development. And Datapoint has a solid track record in DDP, three years of development effort, and a large library of workable software to complement the system. Perhaps, as one of the firm's test site users said: "Well, actually we're doing some very simple stuff on it now. We're still trying to digest it, and our imaginations haven't caught up with us yet."

Hewlett-Packard connects

The recent introduction of HP Distributed System/1000 Software and Firmware have supplied Hewlett-Packard with the impetus to create the architecture for a Distributed Network System (DSN). Previously, DS/3000 software (announced last spring) allowed resource-sharing between HP 3000 computers; and the HP 1000s, which were introduced in 1973, have had some resource sharing capability. But the new systems network architecture allows a wide variety of configurations interconnecting HP 1000s, 3000s, and 2026s (a small data entry and transmission processor).

Indeed, the processors can now share resources on the same net, with most of the functional software being transparent to the user; only the very high-level services will be visible to applications programmers and users, enabling users to treat communications as they would any other activity. In addition, the new networking scheme allows nodal addressing, with store-and-forward capability, and configurations in a "star, ring, or string, or combination or these," according to an HP spokesman. Multiple nodes can also share links.

The major features of DSN include: layered software, which allows functions to remain distinct, and enables changes to be made without disturbing user transparency; universality, which will enable HP products to support other systems as well. Although processing and control will be distributed under DSN, hierarchical configurations will also be supported; standards to be handled include X.25, SDLC, HDLC, and RS-422/423. DS/1000 Firmware and Software to link two HP 1000s costs $6,200, with additional network links selling for $3,700 each. The enhancement to link an HP 1000 to an HP 3000 Series II System costs $500. Deliveries are scheduled to begin in December.

Sycor's linkup

Announced in conjunction with Sycor's new 445 distributed data entry and processing system (the most powerful yet introduced by the firm), Sycorlink allows up to nine 445 processors to be tied together in a network. Disk files on any system can be accessed by any other system in this network; peripherals such as tape drives, printers, and modems can also be shared. Hardwired connections can run up to 5,000 feet long.

The 445 can support up to 256KBs of main memory, 70MBs of disk, eight 2000-character VDT stations (largest CRT yet introduced by the firm), and a combination of matrix and line printers. It can communicate with a host in either bisynch or SDLC, and is source compatible with Sycor's other machines. The 8-bit multiple microprocessor-based 445 will compete with System/34, and a variety of other small business computers from Datapoint, Burroughs, Univac, and Four Phase. A typical 64KB configuration with 5MBs of disk, 5MBs of cartridge drive, a Sprinter matrix printer, and four CRT terminals, as well as communications adapter and most software, will cost about $60,000. First deliveries will be in third quarter, 1978.

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GENERAL-PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370 family and competitors -- comprise the bulk of digital computers by value. They are primarily byte or character oriented and programmed in higher-level language.

Size classes are based on IBM 370s -- instead of constantly shifting average system values -- and which of a of a maker's models competes with which IBM machine, e.g. a computer in Size Class 7 would compete with an IBM 168 or 165. (Other classes can be checked under IBM's column.) Size Class 1 computers have been deleted from this census and included in the SBC Census. An "x" in the last column means not on order from the original manufacturer.

AS OF JULY 1, 1977

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Amdahl	470 V/3	7	$ 75,000	9/77	-	-	-	15
	470 V/6	7	$106,000	6/75	45	9	54	50
Burroughs	B200/300/500	3	$ 6,500	11/61	500	305	805	X
	B700	2	$ 1,450	3/73	2,000	1,100	3,100	1,500
	B800	2	$ 1,250	3/77	60	10	70	
	B1710 Series	2	$ 2,500	8/72	1,150	650	1,800	
	B1776/26/28	3	$ 7,100	2/73	405	190	595	450
	B1800	3	$ 6,400	5/77	5	2	7	
	B2500	4	$ 9,700	2/67	64	74	138	X
	B2700	4	$ 9,700	8/72	400	210	610	X
	B2800	4	$ 15,000	12/76	5	10	15	120
	B3500	4	$ 17,700	5/67	340	260	600	X
	B3700	4	$ 25,000	11/72	340	255	595	X
	B3800	4	$ 19,000	4/77	3	2	5	150
	B45/4700	5	$ 29,500	10/71	355	135	490	X
	B4800	5	$ 35,000	9/76	10	10	20	80
	B5500	5	$ 35,000	3/63	45	15	60	X
	B5700	5	$ 32,000	12/70	12	9	21	X
	B6700	6	$ 63,000	11/69	145	110	255	X
	B6800	6	$ 46,500	6/77	2	-	2	70
	B7700	7	$136,000	8/73	27	11	38	15
	Totals				5,868	3,358	9,226	2,385
CDC	Omega 480-1	4	$ 21,000	6/77	1	-	1	25
	Cyber-71	4	$ 19,800	7/76	3	5	8	10
	Cyber-171	4	$ 27,500	8/77	-	-	-	5
	Cyber-72	5	$ 39,000	10/71	27	66	93	X
	Cyber-172	6	$ 46,000	7/75	13	35	48	25
	Cyber-73	6	$ 56,000	3/72	27	52	79	X
	Cyber-173	6	$ 75,000	9/75	4	33	37	25
	Cyber-74	7	$130,000	3/72	16	12	28	X
	Cyber-174	6	$ 87,000	9/75	9	13	22	25
	Cyber-173	7	$150,000	8/75	2	3	5	5
	Cyber-76	7	$178,000	3/72	4	9	13	2
	Cyber-176	7	$210,000	12/77	-	-	-	2
	G-20	4	$ 19,600	4/61	4	-	4	X
	1604/A/B	6	$ 42,000	1/60	9	-	9	X
	31/3150	4	$ 9,800	12/64	49	19	68	X
	3170	5	$ 21,500	12/70	11	11	22	X
	3200	4	$ 14,700	5/64	34	23	57	X
	3300	5	$ 33,000	9/65	79	54	133	X
	3400	5	$ 23,700	11/64	4	3	7	X
	3500	5	$ 30,000	1/69	32	11	43	X
	3600	6	$ 89,000	6/63	20	13	33	X
	3800	6	$ 57,000	12/65	14	2	16	X
	6200	6	$ 42,000	11/70	-	3	3	X
	6400	6	$ 60,000	5/66	47	46	93	X
	6500	6	$ 82,000	12/67	17	15	32	X
	6600	7	$120,000	8/64	51	24	75	X
	6700	7	$135,000	7/70	3	-	3	X
	7600	7	$183,000	1/69	20	5	25	X
	Star-100	7	$270,000	12/74	4	-	4	0
	Totals				504	457	961	124
DEC	2040	4	$ 10,000	6/76	63	50	113	150
	2050	4	$ 18,800	5/77	1	0	1	40
	PDP-6	4	$ 10,000	10/64	7	1	8	X
	1040/50	4	$ 16,200	10/67	175	145	320	X
	1060/70	5	$ 18,400	6/72	115	90	205	35
	1080/90	6	$ 26,500	6/75	50	35	85	40
	Totals				413	321	734	265
Honeywell	G-5X Series	2	$ 1,750	8/70	240	1,165	1,405	X
	G-100 Series	3	$ 4,700	4/66	100	790	890	X
	G-200 Series	4	$ 10,000	4/61	130	24	154	X
	G-400 Series	4	$ 16,000	5/64	210	195	405	X
	G-615/25/35/45	6	$ 78,000	4/65	40	25	65	X
	G-6023/25	5	$ 30,000	11/73	32	25	57	X
	G-6030/40	5	$ 40,500	6/71	55	130	185	X
	G-6050/60	6	$ 66,000	7/71	90	64	154	X
	G-6070/80	6	$103,000	7/71	45	30	75	X
	G-6180	7	$103,000	2/74	5	-	5	X
	Gamma 10	2	$ 2,500	7/64	-	340	340	X
	Gamma 30	4	$ 10,000	2/62	-	54	54	X
	G-Subtotals				947	3,042	3,989	X
	H-105/115	3	$ 6,200	3/70	315	305	620	X
	H-110/120	3	$ 5,100	1/66	140	120	260	X
	H-125	4	$ 8,300	12/67	25	140	165	X
	H-200	3	$ 7,500	3/64	285	110	395	X
	H-2020	3	$ 3,600	2/73	305	135	660	X
	H-2030	3	$ 5,700	1/73	120	55	175	X
	H-2040	4	$ 12,400	4/72	275	140	415	X
	H-1015	4	$ 13,900	4/71	32	26	58	X
	H-2050	4	$ 18,700	4/72	120	100	220	X
	H-12/1250	4	$ 14,000	2/66	235	96	331	X
	H-2015	4	$ 20,500	2/71	41	28	69	X
	H-2060	4	$ 19,500	4/72	46	22	68	X
	H-2200	4	$ 19,000	1/66	105	31	136	X
	H-2070	5	$ 32,500	5/72	42	3	45	X
	H-3200	5	$ 27,000	2/70	98	38	136	X
	H-4200	5	$ 44,000	9/68	14	3	17	X
	H-8200	6	$ 71,000	2/69	13	5	18	X
	H-4/1400	4	$ 14,000	12/61	12	15	27	X
	H-8/1800	5	$ 35,000	12/60	13	11	24	X
	H-Subtotals				2,436	1,403	3,839	X
	H-61/58	2	$ 2,100	6/74	93	580	673	500
	H-61/60	2	$ 3,100	6/74	60	800	860	
	H-Level 62	3	$ 4,600	10/74	360	345	705	400
	H-64/20	4	$ 9,200	10/74	155	275	430	
	H-64/30	4	$ 10,500	11/76	-	10	10	
	H-64/40	4	$ 13,200	10/74	29	65	94	250
	H-64/50	4	$ 15,700	7/77	-	-	-	
	H-64/60	4	$ 19,800	6/77	-	2	2	
	H-66/05	4	$ 16,300	10/76	28	5	33	
	H-66/07	4	$ 19,100	3/77	1	1	2	40
	H-66/10	5	$ 25,500	6/75	35	55	90	
	H-66/17	5	$ 25,500	2/77	1	-	1	75
	H-66/20	5	$ 36,000	11/74	70	110	180	
	H-66/27	5	$ 35,000	3/77	1	1	2	60
	H-66/40	6	$ 60,000	10/74	31	35	66	
	H-66/60	6	$ 85,000	10/74	37	12	49	40
	H-66/80	7	$107,000	10/74	11	3	14	
	H-66/83	7	$128,000	/78	-	-	-	20
	H-68/80	7	$ 93,000	10/74	5	-	5	
	S-60 Subtotals				917	2,299	3,216	1,385
	HIS Totals				4,300	6,744	11,044	1,385

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IBM	System/3-4	2	$ 1,250	6/76	400	30	430	400
	System/3-6	2	$ 1,700	12/70	1,260	930	2,190	X
	System/3-8	2	$ 2,100	6/75	4,950	3,650	8,600	2,700
	System/3-10	2	$ 2,500	1/70	9,750	6,100	15,850	X
	System/3-12	3	$ 3,600	3/76	3,770	2,100	5,870	3,500
	System/3-15	3	$ 6,500	3/74	2,930	1,450	4,380	700
	S/3-Subtotals				23,060	14,260	37,320	7,300
	3031	6	$ 60,000	3/78	-	-	-	500
	3032	7	$105,000	3/78	-	-	-	500
	3033	7	$170,000	3/78	-	-	-	500
	370/115	3	$ 8,400	4/74	1,270	2,480	3,750	X
	370/125	4	$ 12,000	6/73	1,200	2,020	3,220	X
	370/135	4	$ 19,100	5/72	2,230	2,680	4,910	X
	370/138	4	$ 19,400	11/76	680	390	1,070	2,100
	370/145	5	$ 36,500	7/71	1,760	1,630	3,410	X
	370/148	5	$ 35,500	3/77	350	315	665	1,500
	370/155	6	$ 67,000	2/71	505	315	820	X
	370/158	6	$ 95,000	5/73	1,410	1,270	2,680	250
	370/165	7	$123,000	6/71	120	50	170	X
	370/168	7	$177,000	7/73	450	290	740	100
	370/195	7	$260,000	3/71	14	2	16	X
	370 Subtotals				9,989	11,462	21,451	5,450
	360/20	3	$ 2,800	12/65	1,230	1,930	3,160	X
	360/22	3	$ 3,600	7/71	130	130	260	X
	360/25	3	$ 8,000	10/68	120	395	515	X
	360/30	4	$ 10,900	6/65	1,910	880	2,790	X
	360/44	4	$ 18,100	7/66	45	40	85	X
	360/40	4	$ 18,400	6/65	1,140	740	1,880	X
	360/50	5	$ 32,500	8/65	530	265	795	X
	360/65	6	$ 69,000	11/65	405	155	560	X
	360/67	7	$142,000	6/66	22	13	35	X
	360/75	7	$118,000	1/66	25	17	42	X
	360/85	7	$178,000	10/69	1	2	3	X
	360/9X	7	$191,000	11/67	11	5	16	X
	360 Subtotals				5,569	4,572	10,141	X
	1130	2	$ 2,500	2/66	1,510	1,160	2,670	X
	1401	3	$ 3,700	9/60	545	435	980	X
	1401-G	2	$ 2,400	5/64	16	12	28	X
	1041-H	2	$ 1,750	6/67	5	-	5	X
	1410	4	$ 17,100	11/61	38	24	62	X
	1440	3	$ 4,700	4/63	72	87	159	X
	1460	4	$ 10,000	10/63	14	12	26	X
	1620	3	$ 2,700	9/60	125	91	216	X
	7010	5	$ 25,500	10/63	6	3	9	X
	7030	7	$160,000	5/61	2	-	2	X
	7040/44	5	$ 30,000	6/63	11	13	24	X
	7070/74	5	$ 27,000	3/60	90	14	104	X
	7080	6	$ 60,000	8/61	28	-	28	X
	7090/94	6	$ 71,000	8/60	34	9	43	X
	Subtotals				2,496	1,860	4,356	X
	Totals				41,114	32,154	73,268	12,750
Itel	AS/4	5	$ 20,000	6/77	1	-	1	30
	AS/5	6	$ 37,500	3/77	6	-	6	40
NCR	8350		$ 3,850	6/77	2	-	2	250
	8550	3	$ 9,000	4/76	150	100	250	350
	8570	4	$ 15,000	5/76	20	20	40	75
	Century-50	2	$ 1,600	2/71	530	45	575	X
	Century-75	2	$ 2,000	7/76	60	-	60	40
	Century-100	3	$ 2,500	9/68	325	700	1,025	X
	Century-101	3	$ 3,800	10/72	1,050	725	1,775	X
	Century-151	3	$ 6,000	2/75	290	80	370	20
	Century-200	4	$ 7,000	9/69	300	400	700	X
	Century-201	4	$ 9,400	8/74	310	150	460	X
	Century-251	4	$ 17,500	11/73	80	75	155	X
	Century-300	5	$ 24,500	2/72	85	80	165	10
	315	3	$ 3,400	5/62	100	125	225	X
	315-RMC	4	$ 10,300	9/65	20	20	40	X
	Totals				3,322	2,520	5,842	745
Singer	System 10	2	$ 2,600	10/70	1,500	1,300	2,800	X
Sperry-Univac	III	4	$ 27,000	8/62	88	26	114	X
	SS-80/90	3	$ 8,500	8/58	1	5	6	X
	418 I/II	4	$ 10,700	6/63	50	52	102	X
	418 III	4	$ 40,500	6/69	45	85	130	X
	491/492	5	$ 28,500	12/61	11	10	21	X
	494	6	$ 76,000	2/66	66	58	124	X
	1004	2	$ 1,100	2/63	285	220	505	X
	1005	2	$ 1,900	4/66	220	80	300	X
	1050	3	$ 9,300	9/63	130	55	185	X
	1106	6	$ 43,000	12/69	92	225	317	X
	1107	6	$ 60,000	10/62	4	7	11	X
	1108	7	$ 87,000	9/65	155	89	244	X
	1110	7	$130,000	6/72	58	74	132	X
	9200	2	$ 2,200	6/67	620	630	1,250	X
	9300	3	$ 4,800	9/67	500	460	960	X
	9400/80	4	$ 11,800	5/69	235	420	655	X
	90/25	3	$ 3,700	7/77	-	-	-	150
	90/30	3	$ 5,600	2/75	485	690	1,175	450
	90/60	4	$ 19,500	1/74	80	85	165	60
	90/70/9700	5	$ 23,500	8/72	14	35	49	5
	90/80	5	$ 56,000	12/76	2	1	3	5
	1100/10	5	$ 33,500	4/76	34	27	61	60
	1100/20	5	$ 43,000	4/75	10	27	37	20
	1100/40	6	$ 73,000	7/75	22	33	55	35
	1100/81/82	6	$102,000	3/77	1	1	2	10
	Subtotals				3,208	3,395	6,603	795
	301	4	$ 6,900	10/60	45	4	49	X
	501	5	$ 16,600	6/59	5	-	5	X
	3301	5	$ 23,500	7/64	46	-	46	X
	Spectra 70/15	3	$ 4,400	9/65	4	-	4	X
	Spectra 70/25	3	$ 7,800	9/65	-	7	7	X
	Spectra 70/35	4	$ 13,800	1/67	60	1	61	X
	Spectra 70/45	5	$ 25,500	11/65	190	7	197	X
	Spectra 70/46	5	$ 43,000	11/68	33	1	34	X
	Spectra 70/55	5	$ 40,500	11/68	6	-	6	X
	Spectra 70/60	6	$ 47,500	9/70	25	-	25	X
	Spectra 70/61	6	$ 52,000	3/71	3	-	3	X
	Spectra 1600	3	$ 4,000	1/69	34	-	34	X
	Spectra 70/2	4	$ 13,300	7/71	39	-	39	X
	Spectra 70/3	4	$ 21,600	10/71	17	-	17	X
	Spectra 70/6	6	$ 35,000	10/71	38	-	38	X
	Spectra 70/7	6	$ 42,000	10/71	24	-	24	X
	Subtotals				569	20	589	X
	Totals				3,777	3,415	7,192	795
Xerox	Sigma 5	4	$ 14,000	8/67	128	22	150	X
	Sigma 6	4	$ 22,500	11/70	36	14	50	X
	Sigma 7	5	$ 27,000	12/66	57	9	66	X
	Sigma 8	4	$ 20,500	9/71	5	8	13	X
	Sigma 9	6	$ 50,000	11/71	67	32	99	X
	530	3	$ 3,800	8/73	110	40	150	X
	550/560	4	$ 13,400	11/74	42	5	47	X
	940	5	26,000	4/66	41	3	44	X
	9300	3	$ 8,500	11/64	18	4	22	X
	Totals				504	137	641	X
	TOTALS				61,354	50,415	111,769	18,574

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• BURROUGHS BEEFS UP B 80 FAMILY of small business computers with new high- and low-end models -- B 80-60 and B 80-20, respectively -- to complement its previously introduced B 80-30, -40, and -50. The two new models can have 60KB-120KB of main memory, and can accommodate three different disk subsystems -- double-sided floppy disks, removable cartridge disks, and fixed disks. The B 80-60 can handle more disk and more channels than the B 80-20, and costs about $3,000 more. Standard configurations of the B 80, including 60KB CPU, 2MB floppy disk, 60 cps printer, and CRT can be purchased for under $20,000.

• NORTHERN TELECOM ADDS WHISTLES TO ITS BELLS by purchasing a 12% interest in Data 100, and "agreeing in principle" to acquire Sycor Inc. Northern Telecom, a Montreal-based supplier of PABX and related telephone equipment, is 62% owned by Bell Canada. Its deal with Data 100, a Minneapolis-based intelligent terminal maker, allows it to purchase up to 35% of the U.S. company, either on the open market, or privately. The Sycor agreement involves a stock swap valued at about $77 million (.9 shares of Northern Telecom Stock for each Sycor common share). Sycor is an Ann-Arbor-based maker of distributed processing equipment, and recently (see the story on page five) introduced a new terminal (Model 445) with some innovative software links. Intelligent telephones anyone?

• NCR WELCOMES TWO NEW MODELS TO ITS 8000 SERIES -- the V-8580 and V-8590 -- bringing to thirteen the number of 8000 family members that have been introduced this year (there were only two previously). The two new computer systems are the most powerful to be introduced by the Dayton mainframer; the 8580 is roughly comparable to IBM's 370/148, while the 8590 will take on the 3031. Both new systems operate under NCR's Virtual Resource Executive (VRX), but can also operate in the "N" mode (NCR Century) through firmware conditioning. Processor cycle time for both models is 56 nsec. Main memory on the 8580 ranges from 1MB-4MB, while the 8590 utilizes 2MB-6MB. Communications options, terminals, printers, I/O peripherals, and disk packages abound. Purchase price for the V-8580 begins at $517,600, and for the V-8590 at $720,000, and both are available for monthly rental under 5-year agreements; deliveries will begin in third quarter, 1978.

NCR has also introduced a high-capacity disk storage subsystem -- 6540 -- as well as a magnetic tape storage system -- 6370 -- to complement its new computers. Both of the new peripherals feature faster data transfer rates and are denser than earlier models.

• INTEL RAMS INTO ADD-ON MEMORY MARKET FOR IBM 303X SERIES PROCESSORS, with the first semiconductor memory subsystem for the new computers. The in-7730 memory system is based on Intel's 2147 static RAM, and is both hardware and software compatible with all 303X processors via an interface card set. The interface converts logic levels for the address, data, and controls between the in-7730 and the CPU; the 2147 storage element eliminates high voltage drivers, clocking circuitry, and refresh control logic. The in-7730 also features a memory reconfiguration panel, as well as its own cooling and power systems. It can provide up to 8MBs of add-on memory, and is priced at $65,000 per MB. Deliveries are scheduled to begin in October, 1978.

• BASIC FOUR HITCHES WINCHESTER DRIVE TO A NEW BUNDLED BUSINESS COMPUTER, dubbed the Basic/Four System 200. The new system features a 32K CPU, 10MBs of fixed, Winchester-type drive, a VDT, a cartridge tape drive, and a 120 cps printer, plus an accounting system package (with nine module application packages), and sells for $29,000. Deliveries will begin in February, 1978.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" DECEMBER 16, 1977 • VOL.13,NO.11 P.J.McGOVERN,PUBLISHER

Inside -- POS-tings

EUROPEAN EDP USER EXPENDITURES TO TOP $21 BILLION IN 1977, AND TO REACH $36 BILLION BY 1982

European EDP users will spend $21.7 billion in 1977 . . . on computer hardware, on-site programming, operations, software development, and external services (including software acquisition). This figure is expected to augment by about 10.6% per year through 1982, at which time expenditures are forecast to hit $36 billion. Although this growth rate is somewhat below the 14%-15% climb forecast for U.S. EDP users, it nonetheless represents a lucrative marketplace for EDP manufacturers, particularly U.S.-based makers . . . who continue to dominate the overseas market with over two-thirds of the installed base by value (see EDP/IR,Sept.6,1977).

The European users' buying tendencies point to a maturing market; users are becoming more sophisticated, and thus are exploring new avenues for efficient utilization of their electronic equipment. On the other hand, there are a plethora of new users -- predominantly small businessmen -- who are looking to take advantage of EDP in their operations . . . to increase efficiency, to improve planning, and to give them a competitive edge, not the least of which is an innovative, "modernistic" appearance.

To this end, the European user is continuing to purchase hardware, but the product mix is rapidly changing, from mainframes and peripherals to:

+ Minicomputers

+ Terminals

+ Communications equipment

These areas will be the fastest growing segments of the European EDP spending picture through 1982, realizing annual growth rates of over 20%. In fact, terminals and communications equipment, which garnered only 6.7% of the user's hardware dollar in 1975, will command close to 14% by 1982. These expenditures will be reflected in the development of distributed systems and datacomm networks.

In addition, external services and outside software development will take on increasing importance . . . growing at a 14.5% clip over the next five years, and

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	1973		1975		1977		1978			1980		1982		
	$ Million	% Total Exp.	$ Million	% Total Exp.	$ Million	% Total Exp.	$ Million	% Total Exp.	% Growth 78/77	$ Million	% Total Exp.	$ Million	% Total Exp.	% Annual Growth 82/77
Hardware														
CPUs and Peripherals	4,079	31.7	5,397	31.4	6,785	31.1	7,586	31.4	11.8	9,560	31.5	11,235	31.2	10.7
Terminals and Communications	276	2.1	427	2.5	702	3.2	883	3.7	25.8	1,295	4.3	1,772	4.9	20.3
Other Hardware	411	3.2	486	2.8	541	2.5	567	2.3	4.8	683	2.3	843	2.4	9.2
Subtotal Hardware	4,766	37.0	6,310	36.7	8,028	36.8	9,036	37.4	12.6	11,538	38.1	13,850	38.5	11.6
Consumables	829	6.4	1,097	6.4	1,371	6.3	1,521	6.2	10.9	1,811	6.2	2,220	6.2	10.1
Software														
On-Site Developed	2,736	21.2	3,612	21.0	4,404	20.2	4,731	19.6	7.4	5,611	18.5	6,405	17.8	7.7
Outside Developed	700	5.5	1,060	6.2	1,468	6.7	1,742	7.2	18.7	2,394	7.9	3,073	8.5	16.0
Subtotal Software	3,436	26.7	4,672	21.2	5,872	26.9	6,473	26.8	10.2	8,005	26.4	9,478	26.3	10.0
Other	1,475	11.4	2,112	12.3	2,695	12.4	3,000	12.4	11.3	3,897	13.1	4,901	13.6	12.7
Operations	2,381	18.5	2,985	17.4	3,833	17.6	4,151	17.2	8.3	4,918	16.2	5,541	15.4	7.7
TOTAL EXPENSES	12,887	100.0	17,176	100.0	21,799	100.0	24,181	100.0	10.9	30,319	100.0	35,990	100.0	10.6

gradually claiming 22% of the EDP dollar by 1982. Services will be even more significant among medium- and large-scale computer users, who, despite traditional resistance to packaged software (in lieu of tailored systems), will be looking to cut the labor-intensive software development costs by purchasing applications packages, particularly those of the Data Base Management (DBMS) variety.

Indeed, software acquisition will be the major impetus behind the sustained growth in the services sector. This has, in turn, been fueled by the unbundling policies of the major computer vendors . . . which opened the door for a flood of competitive software packages. IBM's software pricing policies have, however, given the service vendors some stiff competition.

Furthermore, the European services user has also changed tack in regard to utilization of processing services . . . from batch orientation to remote auto-transaction and problem solving. Both of these involve the establishment of networks and more extensive use of data communications, and closely parallel developments in the United States. In addition, services will continue to play an increasingly vital role in:

+ Analyzing and studying new EDP systems and products, and offering them to users

+ Supplementing CPU power

+ Acquainting first-time users with EDP

+ Offering specialized services and custom software packages

IDC study

Information on European EDP user expenditures has been culled from a recent IDC study and analysis of EDP users in thirteen Western European countries, in-

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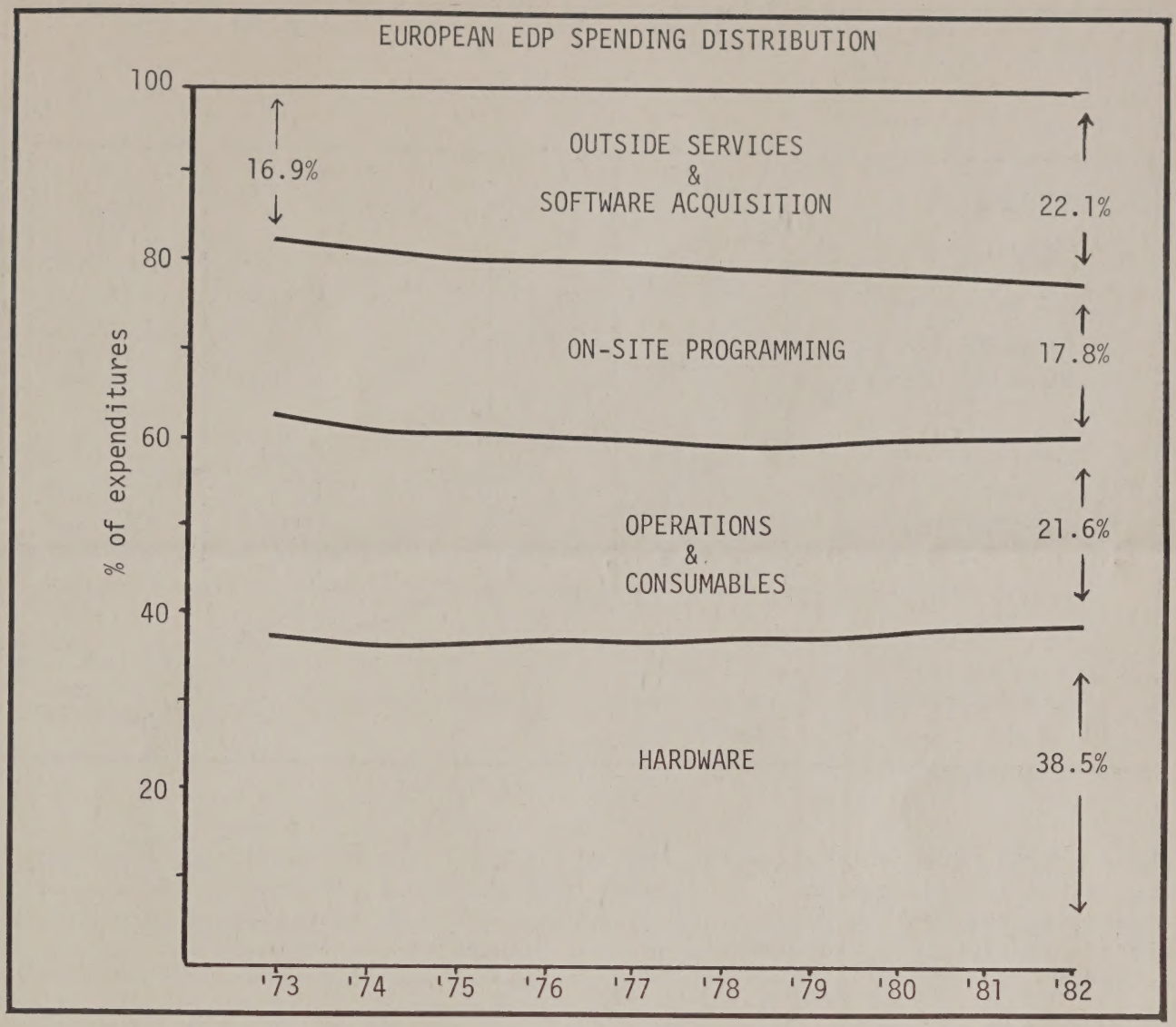

cluding: France, West Germany, Italy, United Kingdom, Austria, Spain, Belgium, Holland, Switzerland, Sweden, Norway, Finland, and Denmark. Communist block countries, as well as Portugal and Greece, were omitted due to insufficient information on their EDP user expenditures.

User expenditures during the 1973-1977 period are based on analysis of data and observations collected by IDC and by other sources. Forecasts are based on extrapolations of observed trends applied to the state of the EDP industry, as well as to the economic and social climates in each of the surveyed countries. The forecasts are thus drawn in the same context as the EDP installed value forecasts made in the Eurocast Studies.

Perspective

The European data processing industry continues to rank among the continent's top industrial performers, and to exhibit strong growth. Over the 1973-1982 period covered in the IDC study, the average annual growth rate for EDP user expenditures is expected to be 13% (based on 15% from 1973-1978, and 11% from 1978-1982).

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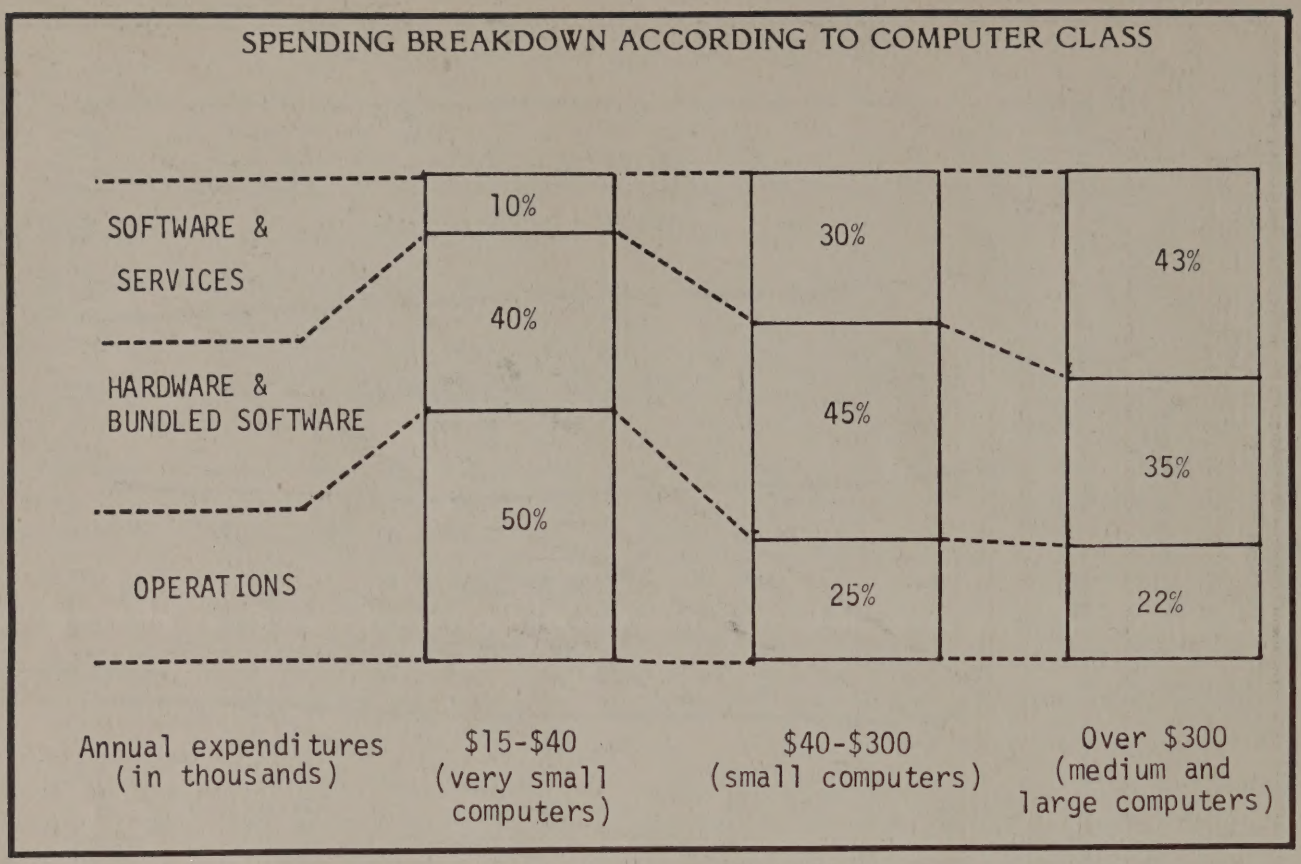

These growth rates illustrate the continuing evolution of the data processing industry, of its adaptation to the users' organizational structures, and of its augmenting role in the total economic environment. It is apparent, moreover, that EDP utilization is moving towards systems that parallel the various divisions and delegated responsibilities within each organizational structure.

The differences between users are important. Generally, firms with a data processing budget below $25,000, who are using a small computer with a rental cost lower than $1,000/month, devote 30%-40% of EDP expenditures to hardware (including incorporated sofware provided by the manufacturer), and 50% to their operations. The portion devoted to on-site software development is very small. As a result, manufacturers marketing this equipment tend to be interested only in outright sales of their machines. It is for this reason that they usually employ service vendors to tend to customers' other needs (maintenance, general or specific software, and even total assitance through turnkey systems development).

For the other classes of equipment users, a significantly larger chunk of the budget is devoted to software, while a smaller percentage is used for operations. Hardware expenditures reach a maximum among users of very small computers, and decrease among users of large and medium computers. Software expenditures show an opposite trend, with large users leading the way.

User expenditures by country

Four countries -- West Germany, Great Britain, France, and Italy -- currently account for over 62% of the European EDP user expenditures. Although all of these nations have relatively mature EDP industries, their users are expected to continue

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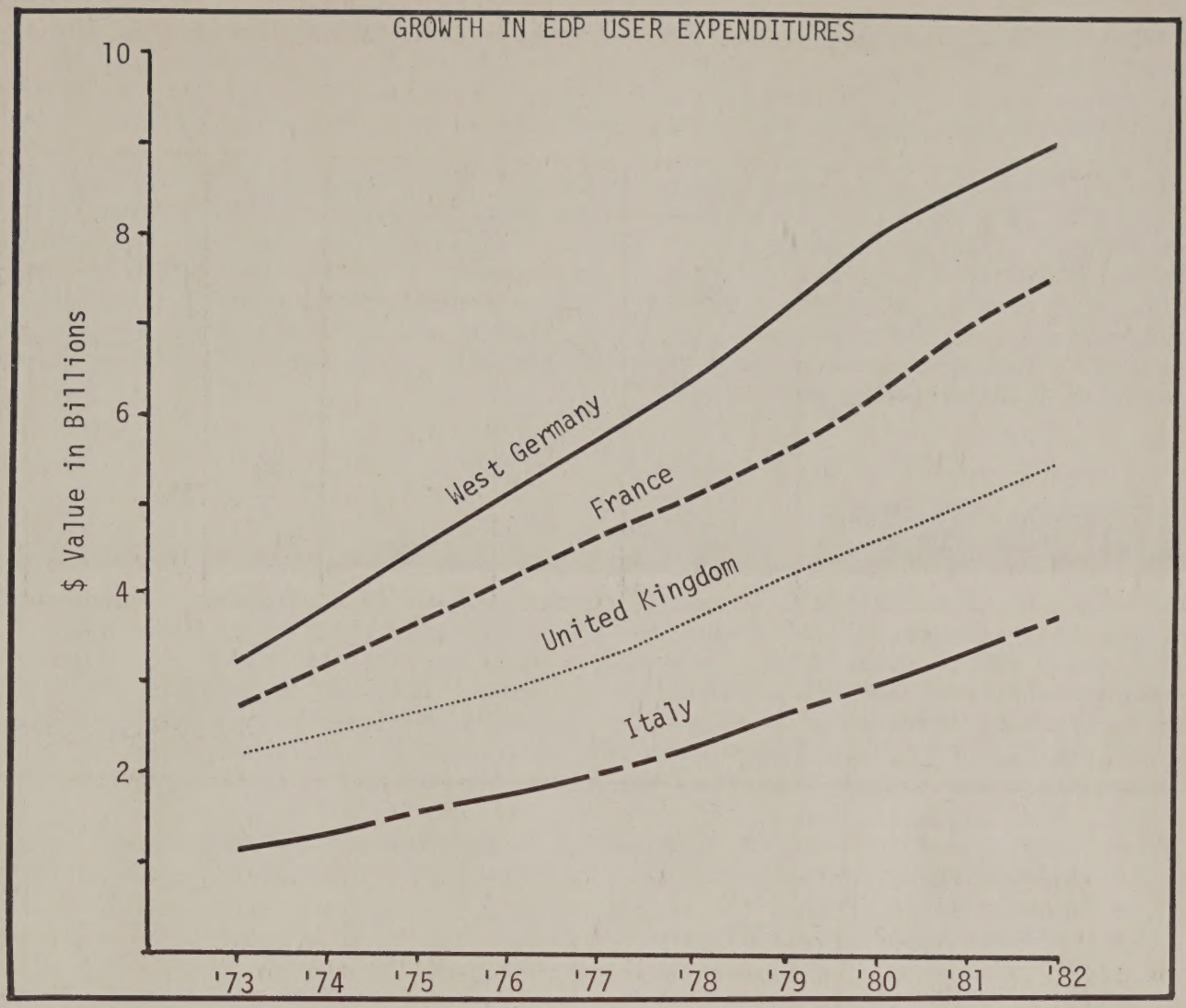

setting the pace in the purchase and development of EDP systems. That is, by 1982, they will still account for 62% of the European EDP spending.

With 1977 user spending of $5.8 billion, West German users lead the continent in EDP expenditures (26.4% of European expenditures). Since 1965, W. Germany's EDP growth rate has easily been the fastest in Europe, but it is now reaching a mature level, and will only grow about 10% in the 1977-1982 period. The major growth areas will be in terminals, communications equipment, and outside software development; EDP services, and the market for very small computers will also be important, as a number of small firms begin utilizing high technology equipment.

French EDP users will spend $4.65 billion in 1977, the second highest in Europe (21.3% of the continent's EDP expenditures). Outside services and software acquisition already command over 22% of the user's EDP budgets. Rent or lease is still the most common means (70% of all firms) of hardware and software acquisition. France is currently struggling through a difficult economic recovery period, and its share of European EDP expenditures is expected to decrease slightly over the next few years, falling to 20% by 1982.

Users in the United Kingdom will spend $3.3 billion in 1977, accounting for about 15% of European expenditures. The UK has the most mature EDP marketplace

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on the continent. As such, the services market, particularly for outside software development, will have a high growth rate -- nearly 17% annually through 1982. Expenditures for network information services currently equal those for batch services. Terminals and datacomm equipment will grow almost 24% a year through 1982.

Italy's share of European EDP expenditures will grow from 9.3% ($2 billion) in 1977 to 10.4% ($3.8 billion) in 1982. This increase in user expenditures will occur despite difficult economic conditions, because Italy is the least saturated of the major European markets. Indeed, it is forecast that more than 50,000 potential users will receive their first data processing system over the next five years. In this environment, hardware will grow 13.5%, led by a 22% yearly climb in terminal expenditures. External services will jump 19% annually, with outside software development realizing a 25% annual growth rate.

\+ + +

POINT-OF-SALE MARKETPLACE RINGS UP SOLID GROWTH

The market for POS terminals in retail stores -- both in supermarkets and general merchandise -- is rapidly evolving, and increasingly is becoming a much sought after niche among EDP manufacturers. Movement towards the utilization of minis, micros, communication nets, and EDP services by the retail industry is fueling interest in its future data processing development. Microcomputers and microprocessors have given intelligence to electronic cash registers (ECRs) for a relatively small cost, and retailers are quickly realizing the advantages of EDP in terms of:

- faster and more accurate information on inventories and cash flow
- improved employee productivity
- improved store image
- increased operations efficiency

Supermarket POS

With nearly 184,000 grocery stores, and about 327,000 checkouts in the U.S. (according to Progressive Grocer), this marketplace appears particularly attractive to vendors of both ECRs and integrated systems. The number of terminals has tripled since yearend 1975 -- reaching 81,400 (65,000 of which are mini-based, or capable of data capture or upgradability) as of June, 1977 (according to a survey performed by IDC's Autotransaction Industry Report). During the same time period, the number of stores utilizing UPC scanners has more than quadrupled; but even more significant, the number of installed POS terminals capable of scanning reached about 65% (although only 0.5% currently perform in this capacity). Consumer resistance has been one roadblock for scanner implementation, but it is being overcome.

Vendors in the supermarket POS terminal business continue to be the old familiar cash register faces, led by NCR with a 70% market share, National Semiconductor with 16%, and Sweda with 8%. New entries, including Data Terminal Systems, are rapidly moving into the markeplace. Earlier this year, the company introduced the Series 540, an ECR capable of scanning, interface with a mini, data capture, and data communications . . . this, to complement its installed base of 43,000 simple ECRs. Indeed, most ECRs continue to be low-end machines -- they don't have data capture or computer linkage ability, and thus are not of direct interest to EDPers. But once again, this balance is in transition; microprocessors will bring not only intelligence, but interconnect ability to many a standalone POS terminal in the near future.

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SUPERMARKET POS TERMINAL INSTALLATIONS

In the U.S. as of July 1, 1977

Vendor and Model	# Installed 12/75	% Market Share	# Installed 9/76	% Market Share	# Installed 7/77	% Market Share	# Terminals w/scanning	-as of July 1, 1977- $ Volume Installed ($M)	$ Volume % Market Share
NCR TOTAL	13,200	60 %	29,000	64 %	56,000	69 %	360	$ 242.8	66 %
255					32,000				
250*					11,000				
Others°					13,000				
National Semi TOTAL	3,000	14	8,000	18	13,000	16	120	62.3	17
T2000					4,800				
T3000					3,200				
T2500*					5,000				
Sweda TOTAL	1,000	4	3,900	8	6,600	8	50	23.7	7
600/80					3,500				
402°					2,000				
425°					800				
Others°					300				
Bunker Ramo ESIS+	3,000	14	3,000	6	3,000	4	--	16.5	5
IBM 3663	800	4	1,000	2	1,800	2	920	15.0	4
Univac Accuscan	--	--	100	--	300	--	50	1.9	--
Others (MSI+, PB-A+)	1,000	4	700	2	700	1	--	3.8	1
TOTALS	22,000	100 %	45,700	100 %	81,400	100 %	1,500	$ 366.0	100 %

* Standalone mode; upgradable to scanning
° Standalone ECRs; no data capture, not upgradable
+ No longer manufacturing or marketing POS equipment

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General merchandise POS

Though it is growing more slowly than supermarket POS, the general merchandise POS terminal sector is still increasing at a 20% clip . . . and the number of POS terminals in general merchandise locations is still double that in supermarkets -- 163,000 as of July, 1977 (according to AT/IR). Still, this sector is being held back by retailers' fears of first generation systems' quick obsolescence, as well as by the inertia of the industry's OCR marking standard . . . but scanning is catching on, according to leading OCR wand-maker Recognition Equipment, Inc., which has installed nearly 10,000 in retail locations. Large department stores are still the major users of POS systems (usually mini or mainframe dependent), but even they are far from saturated (about 43% had installed POS equipment, according to a recent survey). Nonetheless, it is the little retailers who offer the greatest marketplace potential . . . particularly for small systems or intelligent ECRs, and vendors are scrambling to meet these users' needs.

There are currently six major manufacturers who market integrated general merchandise POS systems. NCR had 37.8% of the installed base as of July, 1977; Singer, which no longer market POS equipment, still had 36.8% of the installed base on the strength of its MDTS system. General Instrument had 8.5%, IBM had 5.8%, Pitney Bowes-Alpex had 3.1%, Sweda had 2.7%, TRW had 2.6%, and Datatrol had 1.7%. In addition, ECR maker Data Terminal Systems remains a company to watch in this burgeoning marketplace, that boasts a $650 million installed value.

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• KEEPING IN THE SPIRIT OF COMMUNICATIONS, PARADYNE OFFERS MODEM-SHARING, with the 835 MSD (Modem Sharing Device), that enables up to four standalone intelligent terminals or clustered control units to communicate through a single modem. The 835 MSD can thus reduce the cost of datacomm network modems by 75%, in addition to obviating the need for multiple lines. The unit acts as a serial distributor of control signals, and allows operators manually to halt transmission. The 835 MSD is connected to terminals or controllers via RS-232 connectors, and can be used with any of Paradyne's LSI series modems, or with its MP-48. It sells for $550, and is currently available.

• INTEL MEMORIES GROW ON DEC PDP-11/04 AND 11/34 COMPUTERS to provide 32K, 48K, or 64K X 18 bit memory capacity on a card that is hardware and software compatible with the DEC machines. The in-5034 features parity checking and generation and Control Status Register. The price of the 32K version is $2,625, and it is available immediately. The 48K and 64K models will be available in the second quarter of 1978.

Intel has also introduced the 8049/8039 single-chip microcomputers . . . to expand its MCS-48 microcomputer family. The new micros offer 128 bytes of read/write memory; the 8049 also contains 2KBs of program memory (the 8039 has no on-chip memory). The 8049 and 8039 are software compatible with other MCS-48 family members, and are pin compatible with 8048, 8748, and 8035. The 8049 will be available in December, and will sell for under $10 in large OEM quantities.

• RATHEON DOUBLES THE MAIN MEMORY ON ITS PTS-100 INTELLIGENT TERMINALS, and increases the number of supportable operator stations to 32. The PTS-100, which emulates IBM 3270s, can now handle up to 128KBs of memory, while supporting both local and remote processing. It also features a number of enhancements that expedite interactive transactions by reducing the number of host communications. The PTS-100 with 32 terminals is now priced at $2,899/month on a one-year contract.

• DATA SNATCHERS BEWARE! IBM ANNOUNCES THREE ENCRYPTION DEVICES, two for protection of point-to-point data transmissions, and a third for security in advanced DP installations. The 3845 and 3846 devices (tabletop and rack-mounted, respectively) are aimed at point-to-point transmissions, such as those between a computer and a terminal, and can support a variety of hardware. The IBM Cryptographic subsystem protects data networks utilizing 370s. IBM's encryption method, which uses a 56-bit key (or about 72 quadrillion distinct combinations), has been approved as a Federal Information Processing Standard by the National Bureau of Standards. No programming changes are needed to use the 3845 and 3846, and they sell for $2,125 to $3,600; software is available for monthly license fees, or for purchase.

• DATA GENERAL DRESSES UP ITS MICRONOVA SYSTEMS, adding both I/O interfaces and software upgrades. Digital I/O, digital-to-analog, and analog-to-digital interface boards were introduced, as well as a DG/DAC board for more complex operations. A 4229 High-Speed Data Channel Interface handles throughput at 830K words/sec, and can be linked to the Micronova via direct memory access. A paper-tape reader interface and realtime clock, as well as new line printer interfaces were also announced. A paper-tape software package and a programmable read-only memory burner utility program rounded out the new products.

• NORTHERN TELECOM LURES DANRAY INTO ITS EXPANDING WEB, as it agreed in principle to acquire the Dallas-based manufacturer of computerized PBXs and tandem-switching equipment. Plans call for 100% acquisition for an undisclosed amount of cash.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" DECEMBER 30, 1977 • VOL.13,NO.12 P.J.McGOVERN,PUBLISHER

Inside: EDP in the courts

MAINFRAMERS WIND UP A BUSY YEAR OF INTRODUCTIONS THAT SET NEW PRICE/PERFORMANCE STANDARDS

From an EDP standpoint, 1977 had rather a routine beginning . . . in late January Burroughs unveiled its 7800 supercomputer and its "total system" scientific processor . . . Honeywell the same month announced its "Distributed Systems Environment" and the 66/85, a large-scale "walk-in computer."

It wasn't until March that IBM truly popped the cork on 1977, initiating a new price/performance curve by announcing its new top-of-the-line 3033 processor. By yearend, IBM had rounded out its new processor offerings with the 3032 and the 3031 . . . and EDPland had seen a flood of offerings from other makers who, it appeared, had been waiting in the wings to establish pricing on their new systems. Amdahl had been ready when the 3033 appeared, and within a month after the other 303Xs were announced in October, Itel, Burroughs, Univac, NCR, and Honeywell all had unveiled new systems.

IBM's new computers offer little in the way of new technology -- a denser logic chip in the 3033, larger high-speed buffers (hinting of more microcode to come) than the 370s, and a software/hardware feature called System/370 Extended Facility for running MVS/Systems Extensions (that costs $1250 a month). Memory prices were slashed 30% to the $110,000/MB level with the 3033, and maintained.

Amdahl immediately responded by revising its memory prices downward and by announcing a powered-down, less costly version of its 470 V-6 (called the V-5) and unveiling a new model (the V-7) with 1.5 times the performance of the 3033 or the V-6. Other mainframe manufacturers and the add-on memory makers followed IBM, adjusting memory prices to the new levels on the technology learning curve.

From a price/performance standpoint, the new systems represent another round as significant, when compared to 370-generation computers, as these did over their 360-era predecessors. Indeed, the timetable for deliveries of the new equipment fits right into the five-to-seven year marketing cycle that has become almost standard for the computer mainframe business. But from a structural or architectural standpoint, the new computers -- certainly IBM's -- appear to be merely extensions of the older lines . . . evolutionary enhancements to keep users spending and satisfied over the next few years.

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Demonstrating this strategy, Burroughs and Univac recently announced they were cancelling developments on future-oriented systems and programs. Burroughs abandoned plans for a major revision of its MCP operating system -- to be called MCP VI -- because its users wanted an "evolutionary" rather than a "revolutionary" operating system. Univac cited similar reasons for scrapping its "Project Roanoke," which was aimed at developing a new family of processors capable of running programs from both the word-oriented 1100 series and the byte-oriented 90 series. Both companies plan to incorporate developments into existing systems.

Conservatism seems to be the watchword. Indeed, on a closer look, IBM's 303X series offers few real hardware improvements over its 370 progenitor. Nonetheless, the Armonk Giant received a plethora of orders for the new processors; the waiting list for the 3033 reportedly stretches over two years -- and this set off a wave of profiteering on the delivery time schedule, with early places selling for over $50,000. IDC estimates that about 2500 303X processors will be shipped within the U.S. by 1980, with overseas shipments running close behind.

It is, however, evident that IBM has chosen to deliver its late 1970s computer system piecemeal; more announcements will certainly be forthcoming in the near future, including:

- Tight-coupling (multiprocessing) capacity, to link two or more of the new processors. IBM is the only major mainframer not utilizing this capability -- expected to be a major factor in the future;
- More memory price cuts, probably to the $75,000/MB level;
- More use of microcode in the hardware/software combinations that simultaneously improve system performance and create user dependence on IBM hardware (and not a plug-compatible version).

Mainframer highlights

IBM, besides announcing the 303X series, also introduced the interactive System 34, a small business system with big possibilities. Some new Series/1 software and 3270 and 3790 terminal enhancements were significant.

NCR didn't try to disguise its new generation of Criterion 8000 Series Computers . . . as it introduced thirteen of them in 1977, from the small-business-oriented I-8100 (interactive) through medium- and large-scale N- (Century mode) and V- (virtual) 8400s and 8500s; microcode and upgradability were emphasized.

Sperry Univac announced its BC 7 small business computer in January, and in October, announced five new systems -- the 1100/84 (its biggest yet, comparable to the 3033), 1100/83, and the 1100/80; and on the other side of the family, there was the 90/80-2 (more powerful than a 148), and the 90/80-3.

Honeywell added new Level 6 minis, new intelligent terminals, and announced the 66/85 super computer early in the year. In the last quarter, it unveiled the 68 DPS (Distributed Processing System), a single model available in four sizes -- that cover all of IBM's 303X offerings.

Burroughs had a new announcement almost every month, beginning with the B 800 small system and the 7800 super system, through a number of new 6800 family members, a few 1700 family additions, a scientific processor, terminals, and controllers.

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DISTRIBUTED PROCESSING MAKES THE ROUNDS

1977 was the year the DDP lost its buzzword status . . . it metamorposed from mere concept to real-system in real business organizations. Indeed, users are no long just talking about it, and vendors no longer pitch its virtues without product development behind them. Citibank people, for instance, were much in demand at industry seminars as the usual consultant *savants*. Laying down new product dollars, vendors like Inforex, Data 100, and Mohawk moved closer to the DDP mark; oldtimers like Sycor, Datapoint, and Four-Phase upgraded and announced new products -- and had excellent years. IBM cut prices, shipped its first System/34 (last week), pumped out Series/1s, began pushing 3790s more aggressively, and tweaked SNA's networking capability . . .

There were other signs, beyond dollar commitments on the part of DDP users and vendors, that the phrase is losing its virginity:

- System software is evolving, with real-time operating systems coupled with data base management software working on minis;
- Software-driven resource sharing has arrived -- a prerequisite for true, large-scale distributed data bases;
- Consternation over the definition of DDP is diminishing as the reality sets in. It's the applications that matter . . . intelligent data entry with validation off local files, multiple small business systems running similar software packages in large organizations, POS systems with minis printing management reports;
- Control of the DDP beast is beginning to receive more attention than technology or hardware, as are maintenance and support;
- IBM appears to be softening its centralization stance. Full-page adds touting the 3790, Series/1 emulation of 3270 protocol, S/34's remote capabilities, and flow-on products are quite visible.

So DDP is growing up . . . and with it come side effects. Mainframers and communications giants are on a buying binge; smaller DDP/datacomm companies are, in turn, casting about for capital-rich suitors. DDP stocks are very healthy. Miniperipheral markets -- floppies, cassettes, printers -- are bustling.

Networking is now in the lingo. Datacomm, once a necessary nuisance for DP managers, is becoming the electronic highway to future technology utilization. One industry source claims that by next year, more money will be spent on datacomm and its attendant services than on DP products and services! Packet-switching is a reality, satellites are already handling data traffic, fiber optics experiments in computerized data acquisition and intraoffice communications are currently underway, and digital switching and transmission is beginning to penetrate the phone network.

And it's just the opening procession for a march to the automated office, electronic processing/transfer systems, or integrated information systems -- whatever the name may come to be. Personal computing, home terminals, and even two-way cable TV will be part of the chorus. But 1977 was the year that DDP's part became pronounced. It can no longer be classified as merely a blue-sky or embryonic concept . . . it's happening all around us.

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IBM FILES FOR MISTRIAL BASED ON "SURPRISE" . . . AND OTHER LEGAL NOTES

Three days before the Yule Tide swept in, IBM "unbundled" its Christmas present for the Justice Department and Judge Edelstein . . . a 66 page memorandum with ten appendices, in support of a motion for mistrial. IBM claims that Alan McAdams' testimony (the government's chief economic witness) concerning his definition of a "General Purpose Computer System" considerably differs from the one used by the government in its original statement of judicial issues. Judge Edelstein did not specify a date for a ruling on the motion.

The next day's (Friday) session resumed with David Boies' (IBM lawyer) cross-examination of McAdams. Boies challenged, and demanded substantiation of, the witness's testimony that the IBM 3420 tape drive was strictly anticompetitive, and not an enhanced product. This point represented but one of the many damaging issues addressed by McAdams in his thirty days (which consumed about three-and-a-half months) of direct examination . . . and presaged what will undoubtedly be a lengthy cross-examination (at least a few months), in which IBM will probably attempt to counter each of McAdams' contentions about the nature of the computer industry, the EDP marketplace, and IBM itself. In addition, IBM will certainly challenge McAdams' credibilty as an authority on EDP matters, since computers are not his specialty.

And thus ended THE TRIAL, circa 1977, with two government witnesses yet to be called . . . and the courtroom drama wending into its third year. Although some observers expect the government case to end by mid-1978, other veterans are hopeful that the plaintiff will rest in time to celebrate the decade anniversary of the suit filing (January, 1969). To date, the government has presented 51 witnesses and 3,000 documents . . . totalling 65,000 transcript pages. IBM is expected to present over 5,000 documents and anywhere from 50-to-350 witnesses. Indeed, with IBM likely to occupy two-to-four years presenting its defense, followed by closing arguments and motions, another year or so for the judge's decision, and at least a few years worth of appeals all the way to the Supreme Court . . . this case is a long way from conclusion. There are however, some factors that may truncate the proceedings:

- Successful motions for a mistrial (IBM is sure to keep plugging for legal loopholes throughout);
- Settlement -- rumors abound that lawyers from both sides are seeking to end the marathon, which is causing an enormous drain on the litigants' resources . . . estimated to be about 10% of the DOJ's anti-trust division;
- Successful motion for dismissal by IBM; though this is highly unlikely, the defendant will certainly move for it at the conclusion of the government's case -- leaving the outcome to be decided by the higher courts;
- Interim relief (based on *prima facie* evidence) may be granted if the government seeks it at the end of its presentation. If it is granted, IBM will undoubtedly appeal the "justification" of the decision through the courts; although this may ultimately be dilatory to the trial as a whole, the Armonk Giant may be forced to begin making amends.

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Another year down

The government continued its case early this year with witnesses from AMS (Intersil), Memorex, and CDC; they testified that IBM actions in bundling, maintenance policy, and product introduction adversely affected their companies. This portion of the DOJ case, which began last fall, centered on IBM's:

- FTP and 2319 disk introduction, its memory-bundled mainframes, and its maintenance policies -- which hurt peripheral makers' ability to raise capital, and negatively impacted the add-on market;
- Purchase prices and maintenance policies, which undermined third-party leasing of 370s and of some of IBM's newer peripheral products;
- Preannouncement of equipment, which stymied independent vendors' marketing efforts by keeping earlier IBM customers "in the lurch," so they would buy from their software supplier.

The amalgam of this testimony was that IBM possesses, and wields monopoly power in an effort to maintain market share . . . often to the exclusion and elimination of competitors. IBM countered with its typical defense of "superior skill, foresight, and industry" (supported by Judge Craig in the original Greyhound case), and pointed out that many of the independents, particularly Memorex, had severe management problems and major business mistakes that were responsible for their woes.

Overprotecting interests

However, documents from IBM's own files often proved to be the most damaging to its case. A memo from T.J. Watson, Jr. to his brother Arthur was introduced into evidence by the prosecution. It noted:

> I think the main aim of this company must be to protect and expand our position in the marketplace, and this must be a consideration well above that of profit.

In the U.S. vs. Alcoa, the court determined that Alcoa was a monopolist, and described as illegal its intent to pursue market share rather than profits. Or, more generally, if one begins with a monopoly market share, intent to pursue market share in lieu of profits will be presumed an intent to maintain a monopoly in violation of the antitrust laws.

It was this IBM strategy that the DOJ sought to prove by introducing a number of internal memos and correspondences (IBM's objections that these documents were "privilaged" were overruled) that spoke of price control, anticompetitive, predatory actions, as well as market-share-above-all. The DOJ used Frederick Withington, an Arthur D. Little consultant and computer industry expert, to defend its contention that that IBM dominates the industry (with a 65%-71% share). Mr. Withington was on the stand for 21 days (that covered almost two months) supporting his market analyses.

The unflappable Dr. McAdams

But the DOJ's case truly consolidated around Dr. Alan K. McAdams, an economist, who had followed the case from the beginning, and was able to distill the govern-

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ment's prodigious volume of information, and bring it into perspective. He stated that not only was IBM a monopoly -- through its control of entry, prices, and its dominant market share -- but that it maintained its monopoly power primarily through strategies intended to avoid product-to-product competition with any competitor. He discussed in economic terms the exclusionary effects of IBM's bundling and maintenance policies, and commented that "in the general purpose DP market there was very little entry, and much exit." He also pointed out that while IBM's "adjusted" cash flow return on operating assets averages a phenomenal 50%, from 1960-1972, the aggregate operating loss of all other GP market participants topped $1 billion. He described the "superior skill" which he thought IBM had clearly demonstrated:

> In layman's terms, I would say that the IBM corporation has shown enormous skill, great foresight, and a great deal of industry in attempting and achieving the impacting, and even demise of its competitors.

McAdams concluded that the only cure for monopoly power in IBM's case is divestiture, because regulation would be ineffective, if not impossible.

And so, the trial will crawl on next year, and the next year after that, *ad nauseum*. New lawyers keep appearing before Judge Edelstein, so he must constantly adapt to new styles and presentations in trying to decipher the relevant issues and evidence. He must also keep in mind the experiential advantage enjoyed by IBM's high-powered (and high paid) defense team . . . which may at times outmaneuver the DOJ's turnover-prone, overburdened staff. Furthermore, while controlling his own court proceedings and digesting vast amounts of technical and economic information, Judge Edelstein must also attend to his administrative duties as the top ranking judge in his district court.

Looking ahead, the DOJ will likely seek interim relief. If so, there is an argument that it would be granted by Judge Edelstein: It would allow him to go on record as having rendered an opinion in the case. IBM has yet to "stipulate" the record (an acknowledgement of the proceedings' accuracy) -- undoubtedly because it intends to appeal portions of the DOJ case -- and as a result, if Judge Edelstein should, for any reason step down, the case would have to begin again at point zero . . . a situation both he and the DOJ should like to avoid.

Some observers think the DOJ has a winning case. Lawyer Thomas J. Franklin, veteran IBM trial watcher, told the Computer and Communications Industry Association meeting in November:

> [The DOJ's] market definition is sound. Within that market IBM has a monopoly share and the other indicia of monopoly power. And it has intentionally perpetuated that power by conduct designed to destroy competitors, not to benefit users. I can understand the lack of interest in the case by the general public, but I believe that this audience and the broader audience that will be affected by decision of this case, should count on the government winning the case and should conduct their business strategy on that basis.

EDP/IR is not so sure. We have argued long that divestiture -- perhaps voluntary and orchestrated by IBM under court supervision -- is the most appropriate solution. Short of this, we recognize the analysis that industry participants have pragmatically adopted: Compete with IBM in the reality of the marketplace. Any court-ordered solutions would be considered gifts from Santa indeed.

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JURIS PRUDENCE -- ON OTHER FRONTS

IBM won one, lost two and came out short on a split decision in its major justice hall battles this year.

In February, Judge Ray McNichols directed a verdict against Calcomp in its $300 million antitrust suit against IBM -- before IBM even presented its case. He noted: "The plaintiff failed to make a prima facie case for violation of the statutory provisions relied upon . . . " Calcomp is appealing.

In August, an appellate court set aside the June, 1972 dismissal of the Greyhound v. IBM antitrust case. The Ninth Circuit Court of Appeals "affirmed the directed verdict on the contract issue, but reversed and remanded for trial the monopolization and attempt to monopolize claims. This decision fueled the hopes of other West Coast litigants -- Hudson General, Memorex, Transamerica, and Calcomp -- whose appeals will all be heard by these justices.

Late in the year, Forro Precision won a $2.7 million suit against IBM for general damages resulting from the Giant's intentional interference with Forro's prospective business relations. IBM was awarded $260,000 in its counter-suit claiming misappropriation of trade secrets. No decision was reached on IBM's alleged antitrust violations. All issues were a-pealed.

IBM Canada lost a patent infringement suit to Xerox Corp. -- based on its Copier 1. Xerox, however, granted its competitor a license to continue selling the machines.

AT&T had a busy year. The Consumer Communications Reform Act, better known as the "Bell Bill," resurfaced in Congress, only to be requashed before reaching the floor. A counter-resolution (refuting each point in the Bell Bill), was introduced by Representative Timothy Wirth (D-CO), but it too never hit the floor; it did, however, serve as an educational tool.

More recently, a telephone industry task force (made up of AT&T and small telcos) prepared a proposal for an industrywide reorganization of telecomm services that would drastically alter the cost for business phone service. Many observers are calling it a "back door chunk of the Bell Bill in disguise," and have railed against its anticompetitive overtones; it would particularly hurt the specialized and value-added carriers.

The FCC reaffirmed the 1968 Carterfone decision, and implemented a registration program for telephone equipment -- denying a stay request from the telephone industry. AT&T's proposal outlining the "primary instrument concept" is still under consideration. The Supreme Court cleared the way for the DOJ's antitrust case against Ma Bell, declaring that it did not have immunity from antitrust prosecution due to its regulated status. The 1974 suit is still in pretrial discovery stages . . . the government is seeking AT&T's divestiture of Western Electric and its Long Lines operation.

Finally, there was some bad news for DPers, as New York District Court Judge Constance Baker Motley held that DP professional liability is comparable to that of an architect or an accountant, and thus is subject to malpractice claims by a client. The decision came during pretrial hearings of a Schaefer Brewing v. Electronic Data Systems Corp. suit for DP service contract violation. The ruling should spark a rash of legal proceedings.

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• SILICON WAFERS TURN SOUR ON GALAMAR INDUSTRIES, a subsidiary of Applied Materials, that at one time was the leading supplier of the 3-inch silicon widgets. Galamar, which will be either phased out or sold by its parent, was the victim of a price war that dropped the price of the wafers below $4.00, a level where Galamar's volume could not even approach the break-even point.

• PETRODOLLARS SLIPPED PAST ITT AND AT&T, as Saudi Arabia awarded a $2.5 billion contract to a consortium of European and Canadian telecommunications companies that underbid other international teams. The contract calls for a $2 billion extension of the kingdom's telephone system over a three-year period that will add 470,000 subscriber lines. Operation and management of the system, valued at about $500 million, will span a five-year period.

• MOTOROLA STACKS ITS CHIPS INTO A NEW DISTRIBUTED PROCESSING TERMINAL -- the EPIC 68 -- based on the M6800 MPU. The terminal is completely modular, beginning with a display terminal *sans* keyboard; but through the use of "micromodules," a keyboard, power supply, RAM, ROM, and extra I/O circuits can be added. According to the company, customers (mostly OEMs) will come from a variety of EDP fields -- word processing, manufacturing, systems houses. Motorola hopes to cash in further on the rapidly expanding market for terminal products, and expects to introduce more systems in the near future. A small EPIC 68, without keyboard, costs about $2,100 in OEM quantities.

• CALCOMP THROWS A NEW SWITCH ON IBM, and will market plug-compatible peripheral switches and associated energy saving devices produced by Dataswitch Corp. The Model 1000 peripheral switch is operationally compatible with all IBM 360s and 370s, and allows up to eight IBM channels to be switched between twenty-four peripheral controllers. Prices for the Model 1000 range from $26,000 to $350,000, depending on switch configuration and the number of energy control subsystems that are required. Leases are available, and sales will begin immediately.

• NATIONAL SEMICONDUCTOR UNVEILS A 16-BIT MICROPROCESSOR, that it claims will outperform most 8-bit MPUs. The INS8900 is an n-channel metal oxide semiconductor (NMOS) with 40 pins, and is the highest speed member of the firm's PACE family of MPUs. It features an interrupt structure, addressing modes, and logical capabilities traditionally associated with minicomputers, according to National, and is available for only $10 in large volume orders.

• FACIT SERIALIZES ITS NEW PRINTHEAD BY INTRODUCING THE 4540 PAGE PRINTER, which utilizes print hammers instead of needles or wires to produce serial images. The printhead uses a stored-force principle in which hammers are mounted on flexible arm held back by electromagnets. The holding current is cut off for impact. The light, durable head is guaranteed to produce 500 million characters. With microprocessor control, and a variety of optional interfaces, the 4540 can handle a variety of applications. Twelve character sets, including OCR-A and Katakana are available. Deliveries should begin next year.

• MEMOREX STAYS FLEXIBLE WITH NEW DOUBLE-SIDED FLOPPY DISK DRIVE, the Model 552, that uses two ceramic read/write heads. Conversion of Memorex's Model 550 single-headed disk to a 552 is possible. With a recording capacity of 492KBs in IBM 4694 format, or 1.6MBs in unformatted data, the 552 sells for $585 in OEM quantities.

• EDP/IR WISHES ALL ITS READERS THE BEST FOR 1978 . . .

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JANUARY 30, 1978 • VOL.13,NO.13 P.J.McGOVERN,PUBLISHER

Measured telephone service up for grabs? Page 5

IBM 5110 PUSHES DOWN PYRAMID OF POTENTIAL USERS AS PERSONAL COMPUTER MARKET SETTLES ON BUSINESS FOR FIRST PUSH

> I'm really pleased over IBM's radio commercials for the 5110. People use an auto dealership analogy for the small business computer market and it isn't really valid until you have people coming into the showrooms looking for the product. With enough advertising and customer acceptance and everything else, perhaps this will happen.
>
> -- Joseph A. Walsh, President
> Shasta General Systems

IBM must be a proponent of a similar philosophy, even though its approach to the smaller business marketplace is somewhat different from that of Diablo (the Xerox subsidiary) which chose Shasta to distribute its systems in the United States. IBM wants its name up front because, in addition to "iron" or hardware, it is selling a service concept the computer Giant has built up over the years.

Almost immediately after it introduced the 5110 -- a "low-cost system for business users" -- IBM's early morning and late afternoon drive-time commercials began in earnest. And they stressed the IBM image. One of the first questions asked by industry watchers and participants was, "What is it?" New product? Just market positioning? Move into the personal computer market?

The answer, of course, is most of the above. IBM says the 5110 fits in just below the System/32 in its small business computer lineup and "makes data processing power available to almost every business enterprise." Prices range from just under $10,000 for the "base model" to a fully configured system at almost $33,000.

From a hardware standpoint, the 5110 bears quite a resemblance to the 5100 portable computer introduced over two years ago (EDP/IR Sept.15,1975). A floppy disk has been added and internal performance has been beefed up. For software, IBM offers a few basics, but will count on outside systems houses to make it sing.

But whatever it is, the new computer is hitting customers the right way. Orders are pouring in and even though first deliveries were set for February, late summer is about the soonest a customer not already in the queue can expect delivery of a system. Shipments during 1978 should hit GSD's 4,000 capacity.

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A look at the hardware

"The new system offers the ease of use and compactness of the IBM 5100 Computer plus additional hardware capabilities, language enhancements and improved internal performance," the announcement stated. Similarities and differences between the new 5110 computer and its predecessor:

- Random-access storage of up to 4.8 megabytes is now available through the use of 1.2-million-byte floppy disks in two of the new 5114 two-drive diskette units.

- Read Only Storage is 72K-bit and 96K-bit modules at twice the previous density provides CPU speeds of 3 to 30 times faster, depending on the application. Cycle time was 530 nanoseconds per two-byte access.

- In addition to asychronous capability in which the 5100 and now the 5110 appear as a 2741 communications terminal, the new computer can have binary synchronous capability and appear to the host as a 2770 or a 3741 and therefore interact with a remote System/3, System/32 or 34, another 3741, or other 5110s.

- Expanded screen functions can be under program control. With them the user can read or write data from anywhere on the screen, can display information in upper/lower case, and have audible alarm signals.

The 5110 computer comes in two models: one offers both tape (a la the 5100) and diskette storage, the other provides diskette storage only. The system offers 16K, 32K, 48K, and 64K main memory in both an APL and a Basic version. The new system offers several programming features which facilitate the handling of data, an optional hardware sort feature, and a number of functions to support file handling. The 5100 can be field-upgraded to incorporate most of the features (except for binary synchronous communications and parallel I/O channel) offered on the new 5110. This costs $3,800 to $5,800, depending on the 5100 model.

How the system fits in

It wasn't long at all after IBM introduced the 5110 early this year that various industry observers were asking: "Is it an attempt by IBM to enter the personal computer market?" EDP/IR has pursued this question; the answer, which will need an explanation, is "No . . . and Yes."

Why the ambiguity? As is so often the case in and around the computer industry, the answer has to do with definition. What is the personal computer market? Turns out that it has three elements: The hobby sector, the home or personal portion, and the very small business market. In the order they are listed, these market sectors are (a) small, (b) still in the future, and (c) really hot. In light of this, how does IBM describe the 5110? A small business system below the System/32 in price and performance. So, the 5110 could be described as competing at the upper end of the personal computer market. Clear?

If nothing else, it is certainly clear to EDP/IR that the marketplace for the 5110 is large, and that it opens up yet another strata of users to the marketing efforts of the computer makers. It's hard to drive more than a few miles or read more than a few pages of a business magazine without being exposed to some small computer maker's message.

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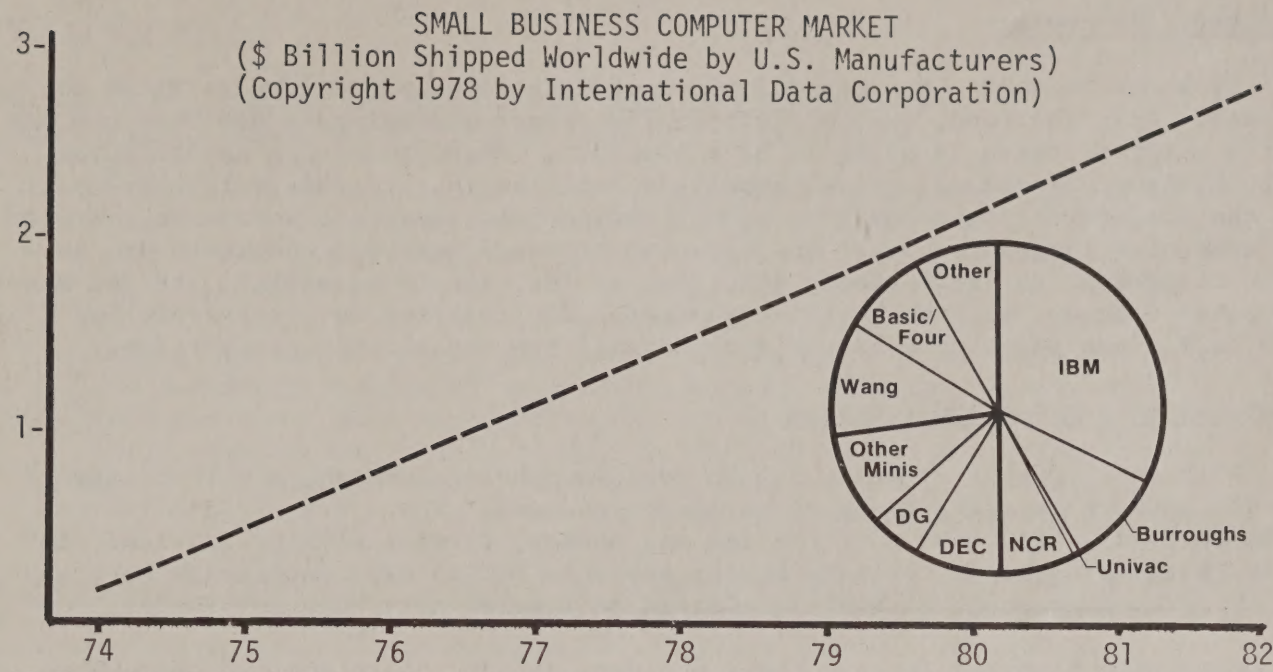

AS THE VALUE OF SMALL BUSINESS COMPUTER SHIPMENTS CLIMBS STEADILY over the next five years, the number will grow even faster since average prices will steadily drop. Insert shows distribution of 1977 $2.6 billion worldwide installed base

One of the first 5110 customers in the Boston area, in fact, was a small business that had looked at the System/32 plus offerings from NCR and Burroughs before deciding that computers were still a bit expensive for his taste. When the 5110 was announced, the friendly IBM salesman telephoned, essentially saying that now the IBM service umbrella could be bought for fewer bucks. Result, a sale . . . even though a systems house was called in for software help.

PERSONAL COMPUTER MAKERS SEE A FEW CLOUDS IN THE FACE OF HEADY GROWTH

For almost a year now, the personal computer makers have watched their products rise in popularity and perhaps compared this popularity to that of calculators or video games. Market growth has been projected at a heady 100% a year with no end in sight. How did 1977 measure up? No numbers are ready yet, but everyone that EDP/IR talked to says their product lines exceeded or met expectations. Some seemed almost stunned by the magnitude of their success. And, even though there are problems ahead, the early part of 1978 brings no pessimism about the prospects for the year.

Demand is so heavy that even the larger companies such as Tandy, parent of Radio Shack, have had trouble expanding production fast enough to meet demand and maintain quality control. TDL, for example, says it has been holding growth to a modest 150% to insure adequate time for management training and a solid capital base. Commodore, with its popular PET models expanding at 100% a month, says its main worry is finding good management personnel fast enough to keep up with what's happening.

This worry is echoed by everyone EDP/IR talks with. As the market grows so much bigger than the collective production capabilities of the industry (as now comprised), literally no one worries about selling every machine they make; what they worry about is capitalization and management training.

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A shakeout is coming

It seems evident that this fairyland of exceeded expectations is fated not to last. Down the road, probably within five years depending on how fast the industry matures, there is going to be a shakeout. When production capabilities meet the level of demand, price competition will begin, and this will drive all but the healthiest companies into making peripherals, into the poorhouse, or into the arms of a larger company. The consumer oriented personal computers are destined to undergo the same bloody price war as the calculator market, and not many companies came out of that battle unscathed. But that's a few years off; for 1978, all signs point to a banner year for all the technically competitive.

Questions of service and software

With small computers going out in ever increasing numbers, a well trained service network is going to be of paramount concern. There are three different possible tacks. For makers of the low end models, service will be provided via retail outlets as it is for many stereo systems. (This will especially be true for the PET, because to date all of Commodore's sales have been mail order.)

For those shooting for the small business dollar, there are two approaches. Some, like Apple and Pertec, are putting together their own regional support systems; others, like Tandy and SWTP, will probably contract with service companies to provide support. Whatever the method, though, it is clear that reliability will be a key factor as the competition becomes increasingly fierce.

And if there is a single hitch in the success story being told here, it is that software has generally been talked of in terms of what will be available and not of what is available right now. The saving grace here may be that most of those who need a turnkey system will not attain enough sophistication to take full advantage of their systems immediately -- thus giving programmers and hobbyists time to generate more programs -- and that those with the necessary sophistication will be able to write any programs not currently available. Manufacturers such as Commodore help out this "cottage industry" by giving priority to programmers on their waiting lists.

Problems for small business

This software lag has showed up most glaringly in the small business market, where the sophisticated problems already exist. Undoubtedly, some businessmen, having heard what kind of software will be available "shortly," have been disappointed at what's there now. One solution will come with the adoption of a 16-bit chip, thus allowing minicomputer software to be adapted. There are 8-bit programs available for business applications, but not many companies have anything like complete packages yet. But it won't be long before a wide aray is available . . . certainly by the end of 1978.

The alternative to pre-packaged software (which may or may not fit the needs of a specific small business) is custom software. This approach, as many small businessmen are beginning to find out, can be expensive. Logical Machine Corp. has what it thinks is a better idea. Its Adam computer comes with English language programming simple enough for most businessmen to use. This costs some computation speed, but is easy. Logical's President John Peers thinks English language programming is the wave of the future -- at least for the small business market -- and he intends to be on the crest of that wave.

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MTS up for grabs?

AT&T's RIGHT TO MONOPOLY ON LONG DISTANCE TELEPHONE SERVICE CLOUDS AS SUPREME COURT REFUSES TO HEAR MCI/EXECUNET CASE

> To fulfill what they perceive as an obligation to manage the rate of change . . . regulators have tended to impose boundaries in an attempt to decelerate momentum to try to make an orderly market, if you will. As the Execunet case clearly demonstrates, however, these boundaries have no permanence because they are not real; in other words, they don't reflect any genuine impediment. Their only effect is a momentary slowing of velocity. Once the boundary is passed, speed resumes. And these boundaries are always passed, sooner or later, because the courts, realizing the artificiality of these boundaries, eliminate them. -- William G. McGowan, MCI Chief Executive to New Orleans Financial Analysts 11/9/77

For once, AT&T and the FCC weren't at loggerheads on an issue. MCI's Execunet service, introduced three years ago, was clearly an infringement of AT&T's sanctioned monopoly on WATS and Message Toll Service (normal long distance) . . . the backbone of AT&T's Long Lines Department and generator of about half of AT&T's 1977 interstate revenues of $11.5 billion.

History

So, in July, 1975, six months after MCI introduced Execunet as a type of shared private line service for business, the FCC deemed that it was, in fact, a switched public message service. The commission ordered Execunet halted. MCI, in turn, took its case to the U.S. Circuit Court of Appeals in Washington, D.C., and was granted a stay of the FCC decision. More litigation ensued. As a result, MCI was enjoined by the court from soliciting any new Execunet business . . . but was allowed to service existing customers. The company's customer base was frozen as of November, 1976, layoffs ensued, and the company went on the ropes financially.

Then, in July of last year, the Appeals Court issued its decision, and MCI won on a technicality . . . a very important technicality [EDP/IR,July 29,1977]. Execunet may indeed infringe on AT&T's WATS and MTS service . . . but the FCC had never proven that it was in the public interest for Ma Bell to have a monopoly in the first place. Hence Execunet was legal.

AT&T and the FCC appealed to the Supreme Court and the industry waited . . . for, if the Appellate Court was upheld, a $6 billion WATS and MTS market (chart, page 6) might conceivably be opened to competition, increasing the open-to-competition sector fivefold. Companies such as ITT, with its USTS subsidiary, Southern Pacific Communications, and others would have a whole new marketing territory for their technologically up-to-date services.

And this month the Supreme Court took action: It would not hear MCI's case; therefore, the Appellate Court decision about Execunet will stand.

The money's in metered usage

MCI terms Execunet a metered usage, private line service. Designed for low-volume users, Execunet allows users to share MCI long-haul circuits and pay for

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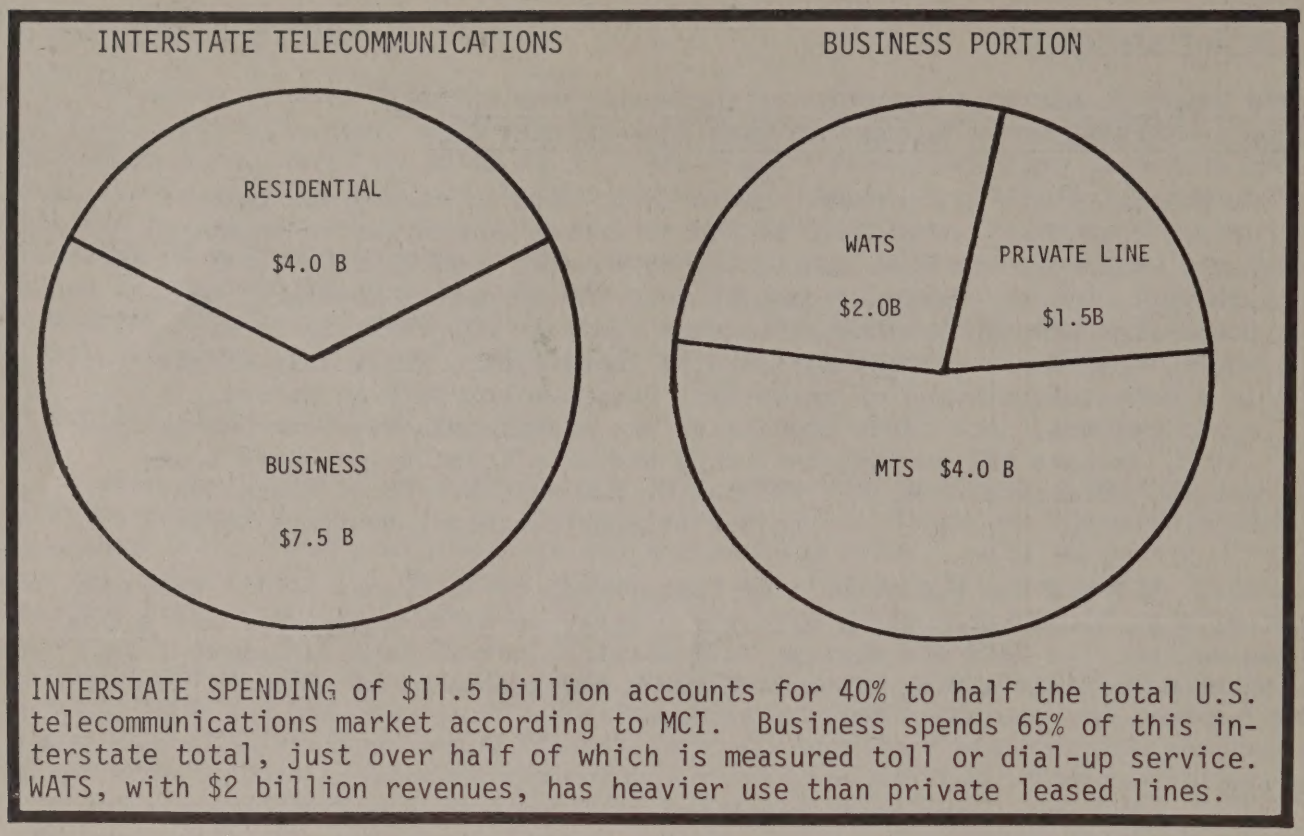

INTERSTATE SPENDING of $11.5 billion accounts for 40% to half the total U.S. telecommunications market according to MCI. Business spends 65% of this interstate total, just over half of which is measured toll or dial-up service. WATS, with $2 billion revenues, has heavier use than private leased lines.

the service according to the distance and time of calls. Normal private line charges are full-period . . . a set fee, no matter how much the circuits are used. AT&T's objections to Execunet stem from the fact that local Bell System loops and switching equipment are used in Execunet to make connections with the MCI trunk lines. The use of tone-signaling equipment (push button telephones) makes this possible.

> (In December of 1976, shortly after its Execunet base was frozen, the company came out with a hard-wired, definitely legal, service -- its Shared Private Line Service. For this, MCI leases dedicated access lines to and from customers -- Execunet uses the switched public network -- and passes the costs on to users. It also eliminates the possibility of intercompany transmission through the use of willingly disemminated access codes.)

At the time the Execunet base was frozen, MCI had 12,000 customers for the service and was generating revenues of $2.8 million a month. At this level, the company was breaking even financially. And now, for all its travails, MCI is profitable, reporting fiscal 1977 (March 31) revenues of $63 million and income of $345,000. In its latest reported quarter, ending September 1977, MCI's earnings were over $1 million. At its current rate of growth -- doubled revenues between FY 1976 and FY 1977 -- MCI will soon be a $100 million operation.

Some points about MCI's revenue mix show why measured-use service is so critical for the company:

- MCI's system is divided 3:1 between leased private lines and measured-use private lines . . . with almost 7 million circuit miles planned for operations by the end of this fiscal year (3/31/78).

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- Nevertheless, over half of MCI's revenues (52%) were derived from the measured usage lines in FY 1977.

In otherwords, because it can utilize its network better with measured-use lines (more customers with lower volumes each), the operating margins can be higher. "The time is not too far distant," says Wayne English, MCI vice president and chief financial officer, "when all of MCI's services will involve some sort of shared use of our facilities."

The Pacific Ocean of revenues

By computer industry standards, the telecommunications market is large -- or comparable size. In 1977 revenues for the total telephone industry topped $36 billion, almost all of which went into the coffers of the Bell System and the 1,600 independent telephone companies that comprise the monopoly carriers. Interstate transmission accounted for $7.5 billion of that as previously noted; local exchange service accounted for $14 billion; intrastate and equipment revenues were $7 billion and $4 billion respectively. Various industry studies indicate that the overall market for voice communications is growing at 8% a year, business telephone use is growing at 15% a year, and data communications at some 20% a year.

With calendar year 1977 revenues probably in the $80 million vicinity, MCI is the single biggest specialized common carrier in existence. Still, its bite on the monopoly carriers is infintesimal. MCI's 1976 revenue growth of $35 million, for instance, was only 3.5% of AT&T's $1 billion growth in long distance revenues. And yearly, according to the FCC, the monopoly telephone industry's growth in the areas open to competition exceeds the total revenues accruing to the independent competitors.

Execunet fallout

With the Appelate Court decision now in effect, MCI can return to marketing its lucrative service and other independents can head for the open fields of that $7.5 billion market (SPC had an Execunet-like service turned down by the FCC before the court decision) . . . with only one catch. The FCC can still hold hearings on the telephone industry's monopoly and its benefit to the public weal; and since all competitive services must be tariffed by the FCC, initiation of such services can be postponed until the outcome of such a public hearing.

Also, AT&T, continuing its fight, has petitioned the FCC to rule on whether or not the telephone companies must provide local circuits to specialized or domestic satellite carriers for anything but private line service. This local loop question could be another large stumbling block . . . at least until rooftop antennas come along.

So, everything is still pretty much as it was, with the exception that MCI's Execunet service is out from under the cloud of litigation and back under the overcast skies provided by the FCC. But, for the time being, MCI's customers can enjoy their lower-cost private line service and MCI can benefit from Execunet's handsome revenues.

The Bell System, meanwhile, although impervious for the moment from MCI's miniscule inroads into revenue . . . has one more reason to turn its attention to marketing and market research. One more reason to become a competitor.

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• TWO MAJOR MINIMAKERS MOVE FURTHER INTO THE SMALL BUSINESS FRAY with additions to their product lines. Digital Equipment has announced its smallest and lowest-cost DEC Datasystem business computer to date; the 308, which incorporates Digital's LSI-based PDP-8 video data processor, will sell for $12,600 to $18,000 and therefore looks like a natural competitor for IBM's new 5110 (page 1). DEC says a typical configuration -- video data processor with 32K bytes of memory, a dual floppy-disk file system, and a minidesk -- can handle such business applications as order processing, invoicing, inventory control, accounts receivable/payable, and payroll. It employs Digital's commercial operating system, COS-310, which the company says has been field-proven in several thousand business applications. The program package includes Dibol.

Data General, in a late 1977 announcement, expanded its CS/40 business computer family by adding two new models with increased disk capacity. The new CS/40 Models C4 and C6 include from one to four 96-Mbyte or 190-Mbyte subsystems. DG says the CS/40 family -- announced in May 1977 and first shipped in September -- now has disk storage capacity increased nearly 20 times, from the previous 40 Mbyte maximum to more than 760 Mbytes.

• ON THE MAXI FRONT OF COMPUTING, Cray Research reports that its computer system installed at the National Center for Atmospheric Research has been purchased. The system -- largest of the three versions offered by the company -- has a sales price of about $8.8 million including peripherals.

• THE MERGER MERGED AND THE SURVIVING NAME IS . . . NIXDORF. Effective the beginning of 1978, the new name of the merged Entrex and Nixdorf will be Nixdorf Computer Corporation, "capitalizing on the 25-year reputation of our parent company . . . and directing our U.S. and Canadian sales and promotional efforts in a unified manner." It will manufacture Entrex data entry and distributed processing systems plus the Nixdorf 8870 small business systems under their present names.

• AN AEROSPACE COMPUTER-AIDED DESIGN AND MANUFACTURING PROGRAM can now be purchased from IBM under its Installed User Program. The Computer-Graphics Augmented Design and Manufacturing (CADAM) System was developed (and trademarked) by Lockheed Corp. With the system, a designer uses a display terminal just as if it were a drafting board, constructing the geometry of a part's design. The system can analyze characteristics such as inertia and shear or bending forces and eventually produce instructions for a numerical control machine tool. Cadam requires a 370/135 or larger host. The cost: Depending on whether or not NC capacility is needed, prices range from an initial charge of $18,000 and a monthly license fee of $1,600 to an initial charge of $41,000 and a license fee of $3,800 a month.

• GOVERNMENT GROUPS LOOK INTO THE TRANSBORDER DATA FLOW STORM THAT IS BREWING, with a National Science Foundation spokesman calling the growing limits on such movement of information a form of protectionism. At a Washington meeting late last year, Federal information managers discussed a 22-page State Department paper. It stated "a paramount interest of the U.S. is the possibility of development of non-tariff barriers that might effectively exclude or hinder our firms in the European markets. National or European-wide legislation can be constructed so rigorously that it effectively restrains U.S. firms from entering or growing in the market." The paper recommended that the Federal government "not commit the U.S. at this time to any particular form of action . . . but should direct its efforts in the coming months towards investigation and definition . . . of legal, economic, and social issues involved in a possible international agreement."

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" FEBRUARY 15, 1978 • VOL.13,NO.14 P.J.McGOVERN,PUBLISHER

Minis and mainframes mix it up

DATA GENERAL ANNOUNCES ITS BIGGEST COMPUTER YET AS MINIMAKERS AIM FOR A NEW AND LUCRATIVE APPLICATION AREA

Keep in mind the significance of today's announcement and Data General's announcement of PL/1 for the Eclipse family. The significance that I'm talking about is the increasing difficulty of distinguishing between the features that are available on mainframe computers and those that are available on minicomputers. . . .

. . . For example, we would expect Fortune 500 companies to offload applications from 370/148 class machines rather than upgrade to more expensive 3031s. . . .

. . . We are extending the minicomputer's capabilities on the performance axis up to that of the medium-scale mainframes, but we are continuing to offer this capability with the same fundamental difference in business mentioned earlier. We're approaching the market with a "tools" orientation, and cost related pricing.

-- Data General spokesmen at the M/600 announcement, January 24, 1978

In the almost mad scramble up the performance ladder from minicomputer to mainframe capability, the country's minimakers are jockeying for assault position on the fastest growing application area for mini usage: Commercial Data Processing and Autotransaction. Where once minis went mainly for automation and control or problem-solving -- in labs, schools, and factories -- now they are going into turnkey DP devices, application-unique transaction processing systems, etc. Data General calls it the "on-line data services" market.

And Data General, with last month's announcement of its largest computer to date, has positioned itself squarely in the front lines of "on-line data services" computer vendors. Other related developments:

- DEC's VAX 11/780, announced last fall, is but one or two steps from becoming a viable tool for entry into this application area. DEC has said it will first satisfy its users in the problem-solving area, then add COBOL capability and aim for more commercial markets . . . .

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- Interdata, another of the 32-bit machine makers, has just announced its plans to "commercialize" its offerings (see page 8).

- Mainframer Honeywell has beefed up its commitment to the Level 6 (see page 6). With its hopes that the Level 6 and its mainframes will combine into a synergistic product line no secret, the company is clearly in line for some commercial business . . . .

And, in fact, most other minimakers are getting more and more involved with end user marketing and systems development . . . as more software and support and growing user sophistication allow minis to perform more of the functions once the purview of the central DP department.

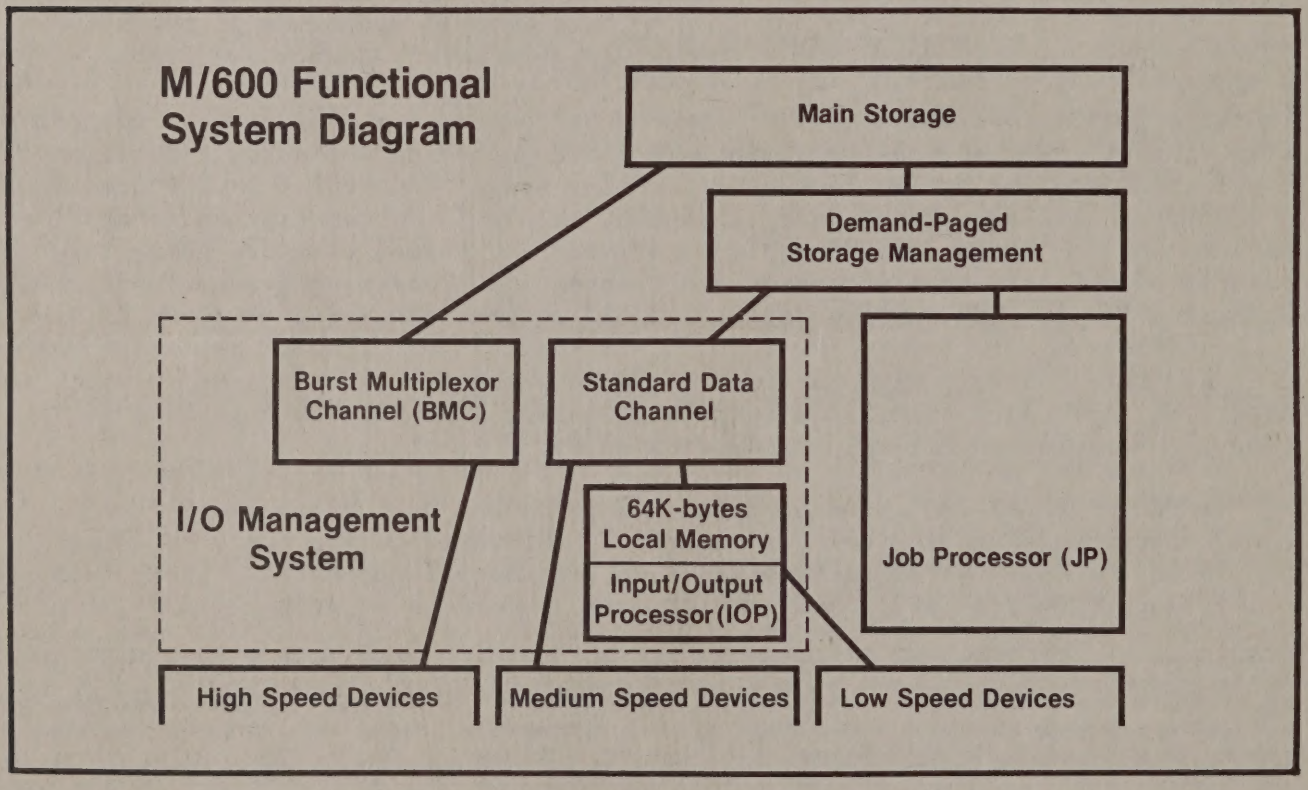
Call this a mini?

Although the M/600 is still a 16-bit mini (at least one trade publication has reported a 32-bit machine is in the works), Data General has managed to overcome the inherent limitations of a 16-bit machine quite handsomely. And current users of the Eclipse won't have to go through a conversion struggle. Keeping it brief, EDP/IR considers the following M/600 characteristics most salient:

- A memory management system that pages data stored in memory onto disk . . . allowing a real memory limitation of 1 MB to be expanded to a virtual limit of 6 billion bytes and up to 64 users to be supported.

- Data General's Advanced Operating System, also available on other Eclipses, which manages the M/600's advanced hardware and monitors system operation and error control.

- An I/O system that provides for high bit-rate throughput -- allowing I/O to keep up with the system's fast (200ns) machine cycle time.



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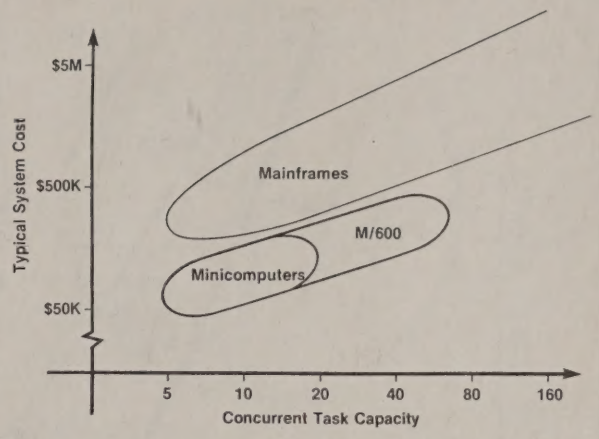
MAINFRAMES VERSUS MINICOMPUTERS

The chart to the right, furnished by Data General, shows the company's conception of the M/600's place in the price performance ladder. Mainframes, DG points out, are capable of handling many more tasks than minis -- for a price -- and are solution oriented.

Minis, on the other hand, are still sold as "tools." But, adds the firm, "sophisticated users are capitalizing on the rapidly declining cost of computing to introduce entirely new classes of applications that are only now becoming cost-justifiable."



The I/O system, shown on the opposite page, is especially interesting. It's a three-tiered system with a very high-speed (10 Mbps) burst multiplexor channel handling I/O from disk to main memory, a standard data channel of 2.5 Mbps for medium-speed devices, and an I/O processor for processing and buffering data from low-speed peripherals. The last device is actually an Eclipse S/130 computer that also acts as a front end for the M/600. Prices for the M/600 run from $160,000 to $400,000, although a barebones CPU will go for around $80,000.

Data General versus DEC

Despite the difference in word length, the M/600's closest minicomputer competitor is probably the recently-announced DEC VAX-11/780. And, in its press briefing, the Southboro minimaker compared the M/600 performance with not only the VAX, but also DEC's DECSYSTEM 2040 and Interdata's 8/32. Data General claimed to have the fastest computing speeds (commercial and scientific) and channel speeds. Some other points of comparison:

- The VAX-11/780 comes with a real memory limit of 2 MB, a virtual space 4 billion bytes. Memory control includes a "request buffer" to eliminate the need for interleaving and works on paging algorithims.

- The VAX can support up to 64 timesharing users, just as the M/600 can. The I/O function is handled by MASSBUS and UNIBUS adaptors.

- Neither the VAX nor the M/600 support COBOL (although the VAX supports PDP-11 16-bit COBOL); both companies say they will in the future.

In fact, the similarities between the two systems may be more important than the differences. Both are "tool" versus "solution" oriented, both build upon a solid minicomputer application base, and both are constrained by the need to remain compatible with smaller systems.

The fertile field of commercial DP

From Data General estimates of the M/600 "on-line data services" market ($1 billion in two years up from $100 million three years ago), the pertinent application area, in EDP/IR parlance, is that for minis used in commercial DP and auto-

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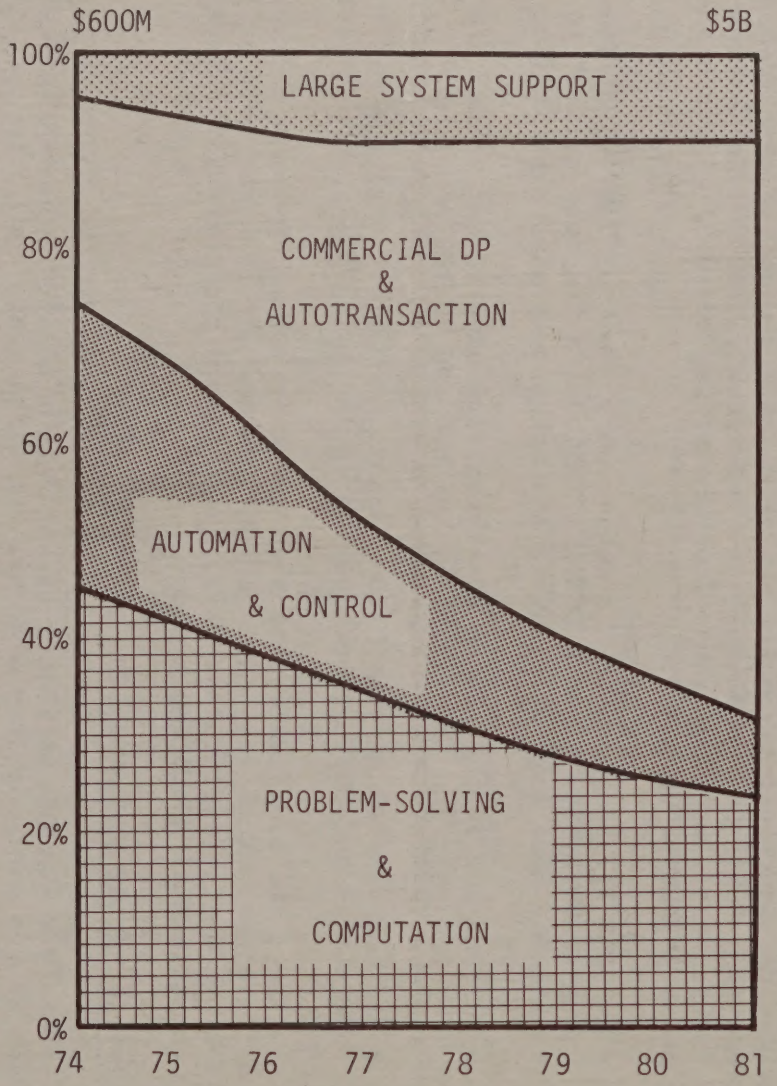
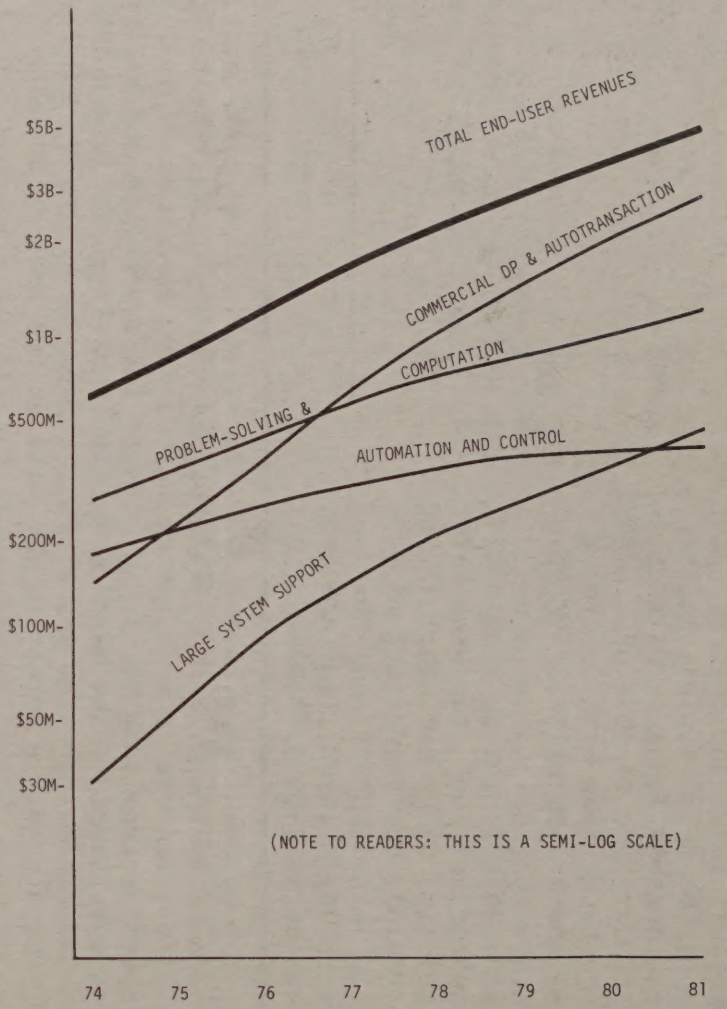
WORLDWIDE END-USER MINI MARKET BY APPLICATION

END-USER MARKET SHIFT



END-USER MARKET GROWTH



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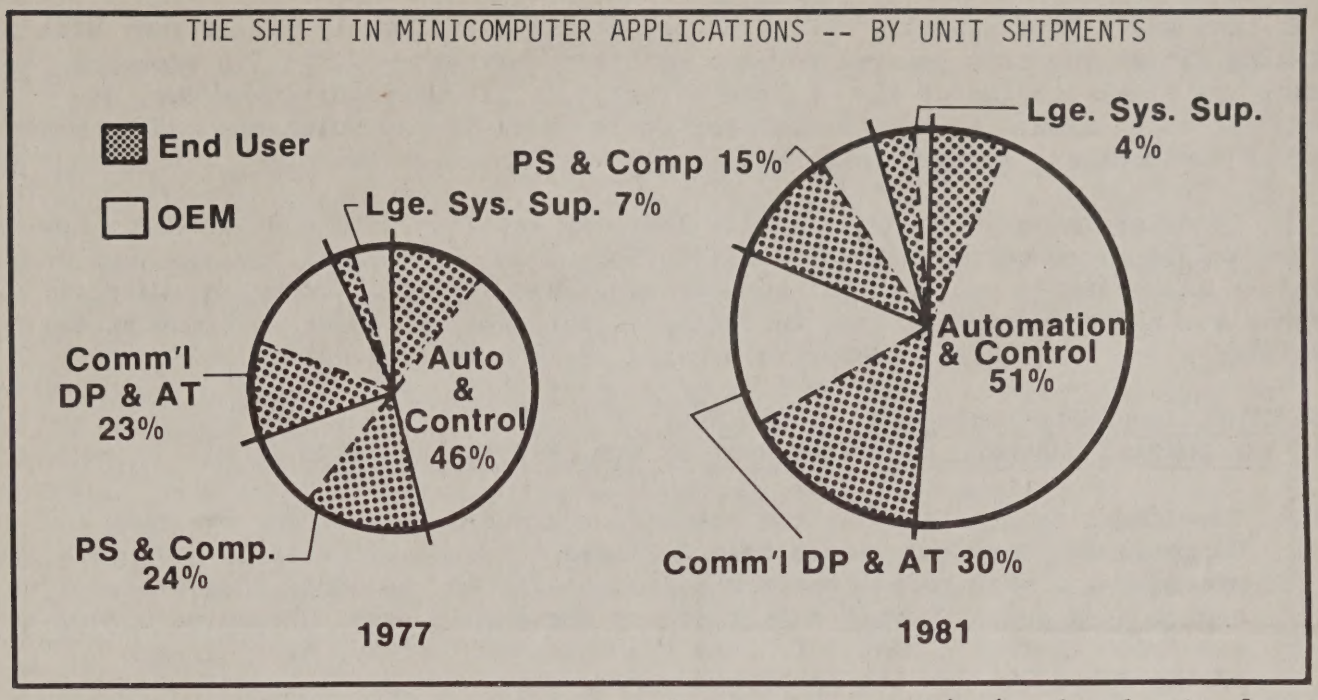


transaction. As the charts on the opposite page show, this is clearly the fastest growing application area for minis today. (Commercial DP includes more than minis used in small business systems, which show slower growth rates than this application area; packaged turnkey systems oriented toward specific industry/application areas, such as many minicomputer distributors sell, are also included).

Some points to note:

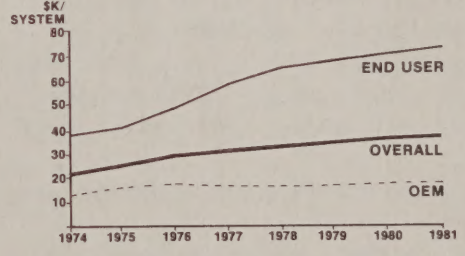
- The end user market in total should yield revenues of $5 billion in 1981 . . . just under half of all minicomputer revenues (including support and software revenues).

- By 1981, 30% of all -- OEM and end-user -- units shipped and 50% of end-user units shipped will be to the commercial DP/AT market . . . at the of the problem-solving market.

- The revenues shift will be even greater: commercial DP/AT will grow from a fifth of end-user mini revenues to well over half by 1981. The average compound growth will be over 50% in end-user shipments.

Another indication of the changing market structure of the mini industry can be seen in the average revenues per mini shipped. While the overall revenues/unit are climbing steadily -- by some $7,000/system between 1977 and 1981 -- the OEM average will stay relatively constant, dropping as microminis influx the market and rising again as system value in support and peripherals is added.

AVERAGE REVENUES PER MINICOMPUTER SHIPPED



The end-user market, on the other hand, will see a dramatic rise in average system value -- over $20,000 -- between 1977 and 1981, even while the hardware revenue portion drops.

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So, while Data General, DEC, and oter minimakers blithely insist they aren't taking aim at the true general-purpose mainframe market -- IBM's 370 province -- they are likely to impact the upgrade market . . . as users discover they are sophisticated enough to use "tools" for devising their own solutions and as minimaker software and support make those tools easier to work with.

It makes one wonder: How long will IBM play catch-up with the Series/1, how long before third parties turn S/1's into commercial DP competitors, and how long before IBM's new low-end general-purpose offerings appear to muddy the waters? Minis are not only rising along the vertical performance ladder in computational ability . . . but edging sideways along the applications ladder as well.

\+ + + +

HONEYWELL ANNOUNCES FOUR NEW LEVEL 6 MODELS AS THE COMPANY NURTURES A GROWING PART OF ITS COMPUTER BUSINESS

> *Commitment is the key. As one competitor groused, "it takes more than three products to make it in this business." Honeywell says it is committed . . . more models and new software will be announced this year, a dedicated sales force has been set up for an OEM push, plenty of money was spent in development. No less than Stephen Keating, the Chairman of the Board, kicked off the press conference.*
>
> -- EDP/IR, January 30, 1976

When Honeywell announced its modular Level 6 minicomputer series two years ago, it indicated there would be more to come. Although industry observers acknowledged the machine had potential, they reserved judgement to see whether and how Honeywell would follow through on its promise. The recent announcement of four new models, which carry the family into the supermini range, is but the latest effort by HIS to nurture the line.

From the beginning, HIS has indicated the Level 6 plays an important part in the firm's plans to become a distributed processing supplier . . . mini revenues now comprise 13% of the firm's overall computer revenues. Two years ago, Clancy Spangle, HIS's chief exec, put it this way: "Not only will minis aid us in making improvements to centralized systems, but they will provide users with a greater choice in the way they want to structure their networks." At the time he estimated that it would be five years or more before distributed systems became a part of the data processing mainstream.

(Will it ever come about, one wonders, when minis are the thing and mainframes merely their processing adjuncts? As an interesting aside, IDC reports that it knows of one user whose mini determined a choice of mainframe. First the user settled on distributed processing as its systems approach, then it settled on the Level 6 as a vehicle, finally it chose a mainframe: a MULTICS 68/80.)

To insure advantageous interplay between its minis and mainframes, HIS has been careful to make its Level 6 GCOS operating system compatible with that on its larger systems. So a user with both Level 66 and Level 6 systems can fully implement Honeywell's HDLC protocol and utilize compatible subsets of Level 66's data base management system and TDS (transaction-driven system) software on the mini.

About the new Honeywell models:

- They are the Model 33, 43, 47, and 53 -- with the 47 a commercial system and the 53 the new top-of-the-line. All are field upgradeable; the

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THE LEVEL 6 CHRONOLOGY

- Introduction on January 20, 1976, of the 6/06, 6/34, and 6/36. Disks were 10 MB and memory capacity was 65K words.

- November 10, 1976, COBOL and BASIC were added; the COBOL is a subset of ANSI 74 COBOL and compatible with that on the Level 66.

- On January 10, 1977, came the third step within a year to increase programming functionality. By this time HIS indicated it had over 1,000 Level 6s in place or on order. The enhancements:

  The 6/40 group was introduced, including the 6/43, a less flexible precursor to the Model 43,; GCOS was added to the Level 6, with multiprogramming capability; RPG was added; FORTRAN and COBOL extensions were added; communications capability and a scientific instruction processor were added.

- A year after its introduction, orders for the Level 6 in the U.S. totaled over 1,000. HIS set up its mini marketing force to report to the small/medium systems division . . . making it look almost like a separate company.

- In May 1977 HIS announced it would lease the Level 6 and unbundled its RBT/300 remote-batch and DST 6/500 terminal software.

- In July 1977 HIS announced a ruggedized version of the Level 6.

43, 47, and 53 can support up to 2 MB of memory and utilize writeable control store.

- A typical Model 33, with 128 KB of memory, 10 MB of disk, a 160 cps printer, and four workstations would cost just over $45,000; a Model 43, more than 1.6 times as fast as the 33, might cost twice that in a typical configuration.

- The Model 47, a "commercial" minicomputer, operates COBOL programs 7 times faster than the 33, executing in parallel instructions generated by COBOL or RPG compilers and other GCOS instructions.

- The Model 53 -- more than twice as fast as the 33 -- includes a new CPU board and 4K words of cache memory. For about $146,000 HIS will part with a 256 KB unit with a scientific instruction processor, two 67 MB disks, card, tape, line printer, and 20 asynch lines.

The new Level 6s also come with a slew of options and peripherals. Memory, for instance, features 16K chips with price reductions up to 42% on the 4K chips. The 16K chips, with error correction and detection, cost about 12.1¢ a byte . . . the 4K chips are down to 8.1¢. For communications, HIS offers adapters to provide high-speed transmission via HDLC and an "intersystem link," which can connect two or more Level 6s. The latter, at a price of $8,000, can transfer commands, interrupts, and memory accesses from any unit on one Level 6's Megabus to any unit on another Level 6's Megabus . . . something of a resource-sharing feature. The disk storage provided quadruples the previous maximum auxiliary storage to 1 billion bytes, printers range in speed up to 900 lpm (50% more than before), and tape drives at 800 and 1600 bpi are also available.

For HIS it's a hefty announcement . . . a renewed commitment.

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• SYCOR BEEFED UP ITS SYCORLINK network by adding an entry level 405 terminal system as little brother to the larger 445. In addition, the firm upgraded software for the 350 standalone terminal system. The 405, which can process two jobs concurrently, can access 445 files via Sycorlink (EDP/IR,Dec.5,1977) . . . the intrasystem network, which uses coax cable and SDLC, can tie together 9 Sycor 400 systems with up to 2,500 feet between units. Sycorlink, available in the 3Q as a field upgrade, costs $2,500. Multiple processor architecture in the 405 frees the main CPU from I/O control. A typical system with 48 KB, floppy disks, a data station, printer and communications costs $19,850. A variety of communications control programs, COBOL, BASIC, and TAL 2000 are available.

Enhancements for the 350 terminal system include a new version of TAL II data entry programming language, IBM 3741 communications emulation, a Report Generator that "closely resembles" RPG II and file continuation support, previously available only on communications models of the 350. The revised TAL II has a less voracious appetite for memory, thereby accommodating larger user programs. The 3741 emulation permits the 350 to communicate with 3741s, 3747s or mainframe hardware, the firm said. The enhancements will be available in April.

• MULTIPROCESSING IN THE COURTS? IBM, in the midst of the antitrust suit filed by Memorex, may have to take time out in April to argue against CalComp's request for an appeal of a directed verdict granted a year ago by Judge Ray McNichols. The U.S. Court of Appeals for the Ninth Circuit granted CalComp's motion for an expedited appeal and requested that the three-judge panel hearing the case schedule oral arguments for April. The same court of appeals last year remanded the Greyhound case against IBM to the lower court for a new trial.

• LESS IS MORE . . . that's what Intel is hoping with its up to 25% price cuts on its iSBC 80/20 and related single board computer products. By dropping the price of its year-old line of products oriented toward the OEM, Intel expects to open up new markets for these products.

• WITH SUPPORT THE FEATURED INGREDIENT, Interdata has bundled its existing 7/32 and 8/32 processors and software tools into packaged 700 and 800 Business Systems, respectively. Although it is trying to approach the end user market in mainframer style -- i.e., offering support and software -- Interdata has neglected to include any applications software . . . thus, some say, the moniker "Business System" could be a bit misleading.

What's new with the system is not the software or the hardware -- although the boxes are off-white instead of blue -- but the offer of support and handholding. Users will receive extensive help in site preparation . . . including review of location of power outlets. The firm offers eight weeks of classroom training for customer operators and applications programmers and will provide 30 days of on-site consultation by its analysts during the first 90 days after installation. A year of hardware maintenance and routine preventive maintenance are included in the bundled price tags, which start at $141,434 for a 700 and $177,929 for an 800.

But Interdata is cautiously assuming the new role of providing support. For the initial six to nine months the 700 and 800 Business Systems will be available in only four cities: New York, Chicago, Los Angeles and Toronto. Software tools include a variety of utilities as well as Cobol and Assembler compilers. Among the facilities are: OS/32 MT; Multi-Terminal Monitor; Business System Transaction Controller; and Interdata Telecomm Access Method.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" FEBRUARY 28, 1978 • VOL.13,NO.15&16 P.J.McGOVERN,PUBLISHER

Mainframers' Revenues Set New Highs: Page 5

HIGHER GROWTH IN MOST SPENDING CATEGORIES PUSHES U.S. USER BUDGETS TO $42 BILLION LEVEL IN 1978

If the usually reliable IDC surveys of user spending continue to show the way of things to come, 1978 looks to be a really super year for the computer industry. Budgets in almost every major category show increased growth over the rate sustained last year. As a result, total user spending is expected to be up 15.5% in 1978, to the $42 billion level. Exclusive of personnel and staff expenses and overhead, the spending increase will be up an impressive 17% over 1977.

The 1978 user spending results presented in this issue are based on a more extensive survey than has been conducted in the past few years. Representative of the U.S. user population of small, medium, and large users, the experience and plans of more than 350 users will be discussed by IDC in more detail at an Executive Conference planned for early April. Highlights:

- Spurred by strong interest in adding or extending on-line capabilities, user DP budgets for 1978 will total $41.7 billion, an increase of 15.5% over the 1977 figures.

- Communications expenditures -- including both equipment and line fees -- will increase faster than any other subgroup and account for over 10% of user budgets in 1978.

- Software and services will continue to rise at a 27% rate in 1978 to account for more than 6% of total DP budgets (not including services bought by non-DP departments). The software figures are even higher, with spending for packages expected to increase 28% while user outlays for custom software and consulting increase some 33%.

- More will be spent for supplies, with the total growing 11% versus a 9% hike the year before. Most of the rise stems from increased use of cards and media rather than forms.

- Staff-related expenses, the largest budget item accounting for over 44% of the 1978 budget, are dropping steadily. The survey reveals a decline of one percentage point per year.

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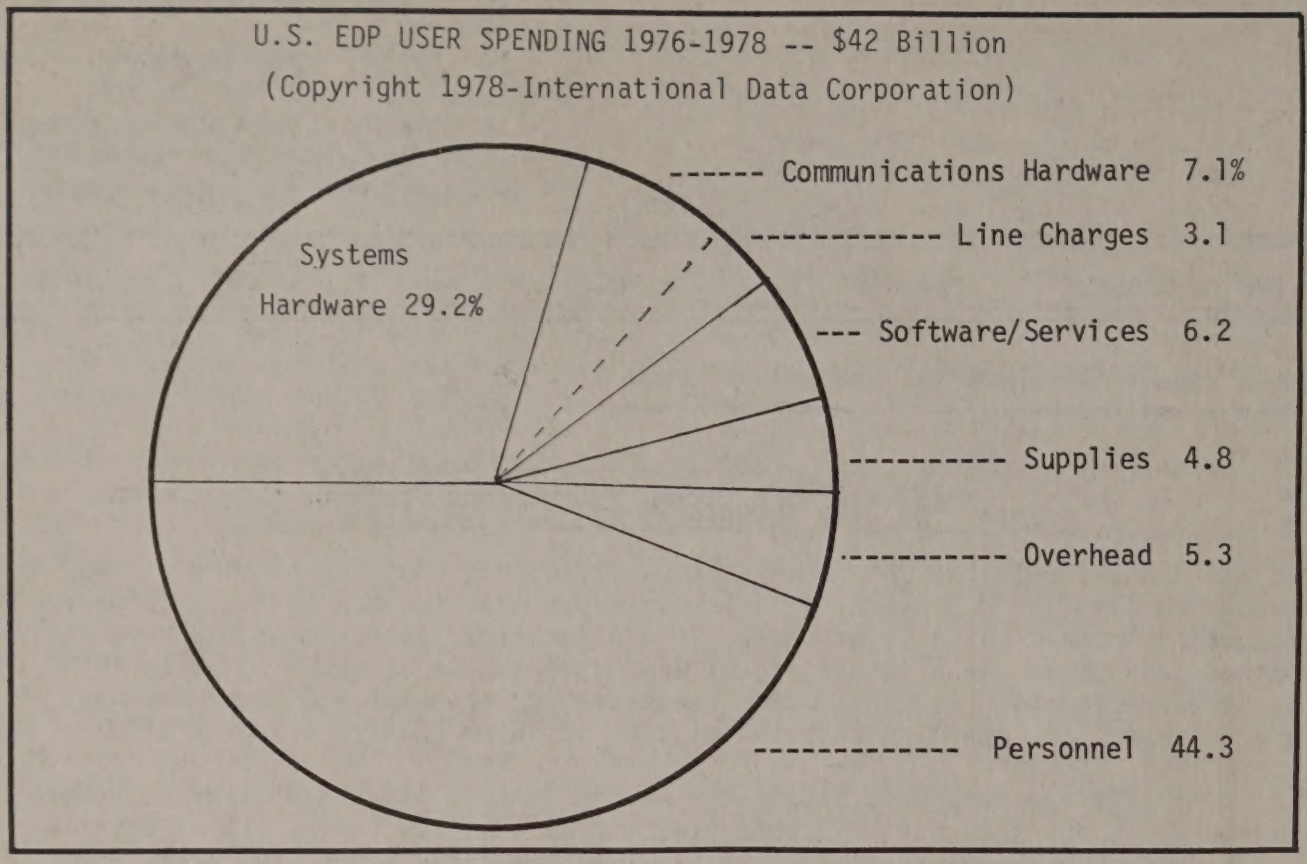

Who gets which part of the pie is the perennial question. Mainframers' revenues should increase but independents, especially the minimakers and vendors of distributed processing and communications gear, will likely share a larger slice of the pie than previously.

(Despite the publicized rush to order 303Xs from IBM and the parade of offerings by other vendors, about 40% of the respondents expect to spend less with their mainframe vendors this year than last. For 1978, 36% of users plan CPU upgrades or additions, vs. 42% in 1977 and 30% in 1976.

Additional terminals and disk units are on the shopping lists of over 40% of the users, and over 30% plan to acquire minis or major equipment other than CPU, memory, disk, tape and terminals. As can be seen from equipment acquisition plans, users, both small and large, are participating in the trend toward teleprocessing and data bases. In contrast to the early part of the decade when DP managers were under pressure to cut costs, large users did not mention any budgetary pressures. Instead, some mentioned pressure to improve their operations regardless of cost.

A look at the methods of acquisition reveals dwindling enthusiasm for short term plans such as rental from the manufacturer and preference for long term schemes such as leases -- either from the vendor or a third party -- and purchases.

Subsectors

Users' anticipated expenditures for services show minuscule growth for 1978, but this does not mean that industry sector's growth pace is lagging compared with the rest of the industry. Rather, the survey did not reach those who are most

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U.S. EDP USER SPENDING 1976-1978
(Copyright 1978-International Data Corporation)

	1976 $M	77/76 %Δ	1977 $M	78/77 %Δ	1978 $M	1978 % Total
Systems Hardware	9,805	11	10,915	12	12,180	29.2
Software	1,400	31	1,830	30	2,370	5.6
Services	200	13	225	9	245	.6
Software/Services Subtotal	1,600	28	2,055	27	2,615	6.2
Data Entry, Data Comm. And Other Remote Equipment	1,745	25	2,180	35	2,940	7.1
Communications Line Charges	850	20	1,020	28	1,305	3.1
Communications Subtotal	2,595	23	3,200	33	4,245	10.2
Supplies	1,675	9	1,825	11	2,025	4.8
Staff Related Expenses	14,800	10	16,280	13	18,395	44.3
Overhead	1,525	20	1,830	23	2,250	5.3
TOTAL BUDGET	32,000	12.8	36,105	15.5	41,710	100.0

likely candicates -- and users -- of outside services, specifically, departments that do not put all of their applications on the inhouse computer as well as those businesses that do not have any inhouse DP capabilities. In fact, IDC figures project the services sector revenues will grow at a compound annual rate of 17% from 1977 to 1982, reaching $9 billion in 1982 from $4.185 billion in 1977.

Software continues a strong growth rate as the "not invented here" syndrome deservedly fades into the blacker pages of many corporate histories. Packages and skills in strong demand pertain to data base management, data dictionaries, telecommunications, system utilities and specialized industry applications. As in the past, the allocation for software packages is about twice as large as that for custom software and consulting. Quite possibly the popularity of software packages may be a major factor assisting the DP manager in holding personnel costs to less than 50% of his budget.

Communications costs, sometimes difficult to aggregate, have edged up two points since 1976 to 10.2% of users' budgets. But along with these increased expenses have come some savings in the staff area -- at least as shown on the DP department's books. While dispersing the data entry function to other departments, the DP manager reduced staff expenditures from 46.3% of his budget in 1976 to 44.3% in 1978 -- a two point drop. And just as the dispersement of data entry equipment may be reducing the DP department's personnel costs, it eventually may also contribute to a reduction in that department's communications costs if the gear in other departments is itemized on the user departments' budgets. Both small and large users seem to be implementing communications.

But for all this splurge in communications, users generally are not rushing to implement SNA and SDLC. Some, who already have communications systems in place, question why they would want to start all over again with new architecture and all

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U.S. EDP USER SPENDING: 1976-1978
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	1976 $M	77/76 %Δ	1977 $M	78/77 %Δ	1978 $M	1978 % Total
Systems Hardware						
Rental or Lease Payments to Manufacturer	5,185	5	5,445	12	6,100	14.8
Lease Payments to Third Party	1,295	20	1,555	13	1,760	4.2
Depreciation Charges for Purchased Equipment	1,950	15	2,245	12	2,515	6.0
Capital Expenditures for Expensed Purchases	550	30	715	-	715	1.7
Maintenance Charges on Owned Equipment	825	16	955	14	1,090	2.6
Systems Hardware Budget Subtotal	9,805	11	10,915	12	12,180	29.3
Data Entry, Data Communications And Other Remote Equipment	1,745	25	2,180	35	2,940	7.1
All Hardware	11,550	13	13,095	15	15,120	36.4

the associated costs and frustrations. Nor are they lining up to commit substantial portions of their communications budgets to independent carriers. Probable factors for their reluctance are Datran's demise and AT&T's increasingly competitive stance. Those planning to use independent common carriers said they do not expect to allocate to the independents more than a fraction of their total communications workloads.

Although the difference between the percentage increases for line charges and equipment between 1976/77 and 1977/78 are about the same, 8% and 10%, respectively, it will be interesting to see whether there is any great disparity in the future. The 35% rise in equipment expenditures this year could presage a sizeable jump in line expenditures in the future.

Personnel costs slowly continue to shrink in importance, as mentioned above. In both 1977 and 1978 the rate of growth failed to keep pace with that of overall DP spending. However, people still account for a hefty 44.3% of the budget and EDP/IR thinks it unlikely this figure will shrink much more than one percentage point per year of the total budget in the near future.

Industry Impact

In the U.S., hardware continues to account for just over 36% of the user's budget, set to grow from the $13 billion level in 1977 to over the $15 billion mark this year. This growth of 15% translates directly into industry revenues.

Within the system hardware portion, users expect to beef up their rental/lease payments to manufacturers while holding increases in third-party lease payments to the 12% level. Last year, payments to third parties increased some 20% while payments to manufacturers grew only 5%. An even bigger boost -- accounting for almost half the total increase in user spending -- will come from remote equipment spending. After an increase of 25% in 1977 to the $2.2 billion level, this hardware sector will grow another 35% to almost $3 billion. Thus, as users turn to remote processing and trim total budgets by allocating a little more on hardware, the impact on industry suppliers is widespread. If user plans are to be believed, 1978 looks like a super year for computer equipment manufacturers.

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MAINFRAMERS' 1977 REVENUES RISE 15.8% BUT NO ONE ENCROACHED ON IBM'S SHARE

Mainframers' report cards for 1977 show a banner year for both revenues and earnings. In addition to corporate profit pictures, the seven vendors gave indications of revenues derived from computer operations which, for the group, rose an average of 15.8%, outstripping a 13% rise in user spending during the year. While some companies gave specific numbers, others hinted at what percent of overall revenues stemmed from computer operations. The figures presented here represent what the vendors say about their businesses -- and not all classify computer operations in the same way.

Although 1977 was a banner year for nearly all mainframers, IBM managed to retain over 62% of the total computer revenues of seven mainframers. The gap between IBM's shares -- 62.4% in 1976 and 62.6% in 1977 -- and those of the closest contender, NCR, did not diminish. NCR's shares remained firmly entrenched at the 8.2% mark in both years.

Just as the gap between IBM and the rest remained constant, there was little shuffling among the ranks. The one notable exception was Digital Equipment Corp. which, with a 43.9% increase in 1977 revenues, surpassed Honeywell Information Systems and gained sixth place in revenues from computer operations. DEC's share of the mainframers' combined DP revenues rose from 3.6% in 1976 to 4.5% in 1977. The shares of Burroughs, Control Data Corp. and HIS declined slightly.

A look at the accompanying figures shows HIS and NCR revenues from computer operations have been heading in opposite directions. Since 1972, HIS, with revenue growth of 1.3 times over the six-year span, has plummeted from the position of third to seventh. NCR, whose DP revenue has tripled over the six years, has progressed from sixth place to the number two slot. DEC, with the highest revenue growth of any other company on the chart, 5.6, bears watching in the future. Burroughs and CDC grew at identical rates and exceeded IBM, which doubled. Univac slipped from second to fourth place, growing only 1.6 times.

With the exception of DEC's 43.9% increase in computer revenues from 1976 to 1977, the increases ranged from 16.1% to 8.2%.

Individual Performances

As a group, the mainframers' computer operations revenues grew 15.8% between 1976 and 1977. And in some cases, individual companies' earnings from computer operations matched or exceeded that figure.

- HIS' earnings from its computer business nearly doubled to $79 million from $49 million in 1976.

- CDC's earnings from its computer operations jumped 60.6% to $20.2 million from $12.5 million last year.

For many, the year was notable for the adjustments in foreign currency exchange. There were some who benefitted and some who did not. Sperry Rand's nine month earnings would have risen another 3 points to a 10.4% gain if such adjustments were not considered. Honeywell said exchange adjustments cost it 30 cents a share in 1977 whereas in 1976 they contributed 34 cents a share. IBM's foreign currency gain totaled $28 million for the year.

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SYSTEMS MANUFACTURERS REVENUE GROWTH ($ Million - Computer Operations)							
	1972	1973	1974	1975	1976	76/77 %Δ	1977
IBM	7,531	8,684	9,887	11,116	12,717	16.1	14,765
NCR	657	885	1,122	1,415	1,674	20.4	1,944
Burroughs	768	950	1,180	1,357	1,510	11.9	1,690 e
Univac	980	1,120	1,290	1,430	1,470	8.2	1,590 e
CDC	684	948	1,101	1,246	1,358	11.4	1,513
DEC	188	265	422	534	736	43.9	1,059
HIS	774	843	856	856	914	13.4	1,037
TOTAL	11,582	13,695	15,858	17,954	20,379	15.8	23,598
IBM%	65	63.4	62.3	61.9	62.4		62.6

As revenues and earnings grew, so did backlogs. Chairman Frank T. Cary said IBM's backlog is "well in excess of last year, even though 1977 shipments exceeded the high levels achieved during the previous year." Burroughs' backlog was up 15% over that of 1976, and Univac's rose 30%.

IBM Report Divulges Data on Business Segments

This was the first year IBM broke out its revenues by activity and by geography. Interestingly, in reporting its DP revenues more precisely, IBM simultaneously said that the percentages it has given out in the past are not for comparable activities. Thus, the track of IBM's DP business has a discontinuity, primarily based on the addition of supplies to the figure. For example, using percentages given out by IBM last year, the above IDC chart shows IBM's 1977 computer revenues grew 16.1%; but IBM in its annual report cites a 10.1% growth for the year.

In its annual report, IBM said its DP segment includes "DP machines and systems, computer programming, systems engineering, education and related services and supplies for commercial and government customers."

However, the office products segment includes information processors and document printers. The third segment, federal systems, features "specialized information-handling products and services for U.S. space, defense and other agencies and, in some instances, other customers." The fourth category, "other," includes educational materials and services.

Material interdependencies and overlaps exist among IBM's operating units, the report indicated.

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MAINFRAMERS' EARNINGS AND REVENUES 1976-1977

	Earnings ($ Million)			Revenues ($ Million)		
	1976	1977	%Δ	1976	1977	%Δ
IBM	2,398	2,719	13.4	16,304	18,133	11.2
NCR	96	144	50.0	2,313	2,522	9.0
BURROUGHS	186	215	16.0	1,902	2,127	12.0
SPERRY RAND	150	165	9.8	3,268	3,475	6.4
CDC	44	63	42.4	1,358	1,512	11.4
DEC	73	109	48.6	736	1,059	43.9
HONEYWELL	113	145	28.0	2,515	2,909	15.6
TOTAL	3,060	3,560	16.3	28,396	31,737	11.8

Results for 12 month period ended Dec. 30, except for DEC, July 2.

Silver Cloud Has Grey Lining

Although IBM's increase in earnings was boosted by the 19% rise in outright sales, these sales had their pricetag, Armonk indicated. The "cost of sales of DP equipment increased at a somewhat higher rate than related gross income, due in part to the change in the mix of products sold, as well as the costs of supporting new installations," the IBM annual report observed. The corporate cost of sales rose 15.1% compared with a 19% gain in related gross income.

Rental and services revenue for DP equipment grew only 6.7% but the cost of these activities increased at a lower rate than related gross income. The corporate cost of rentals and services increased worldwide by 4.6%, "and, overall, compared favorably with the increase of 6.7% in related gross income," IBM said.

Looking at the overall breakdown, IBM's revenues jumped 11.2% to $18.13 billion and earnings rose 13.4% to $2.72 billion. Outright sales reached $7.09 billion while rental and services revenues were $11.04 billion. Outright purchase activity in the U.S. continues to be higher than that of non-U.S. operations, but IBM indicated foreign operations have experienced slightly higher rates of increases than the U.S. recently.

Growth Rate of Foreign Operations Spurts

The growth in both revenues and earnings of foreign operations outpaced those of the U.S.; foreign earnings edged up one point to 45.2% of total corporate earnings and to over 50% -- 50.3% -- of IBM's revenues. Last year the U.S. and the rest of the world each held a 50% share of total revenues. Foreign earnings rose 16% to $1.23 billion compared with an 11.2% gain in domestic earnings to $1.49 billion. Foreign revenues increased 12% to $9.13 billion compared with a 10.5% increase in domestic revenues to $9.01 billion. Europe contributed 95% of the $6.4 billion revenues from Europe/Middle East/Africa.

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DISTRIBUTION BY SIZE CLASS

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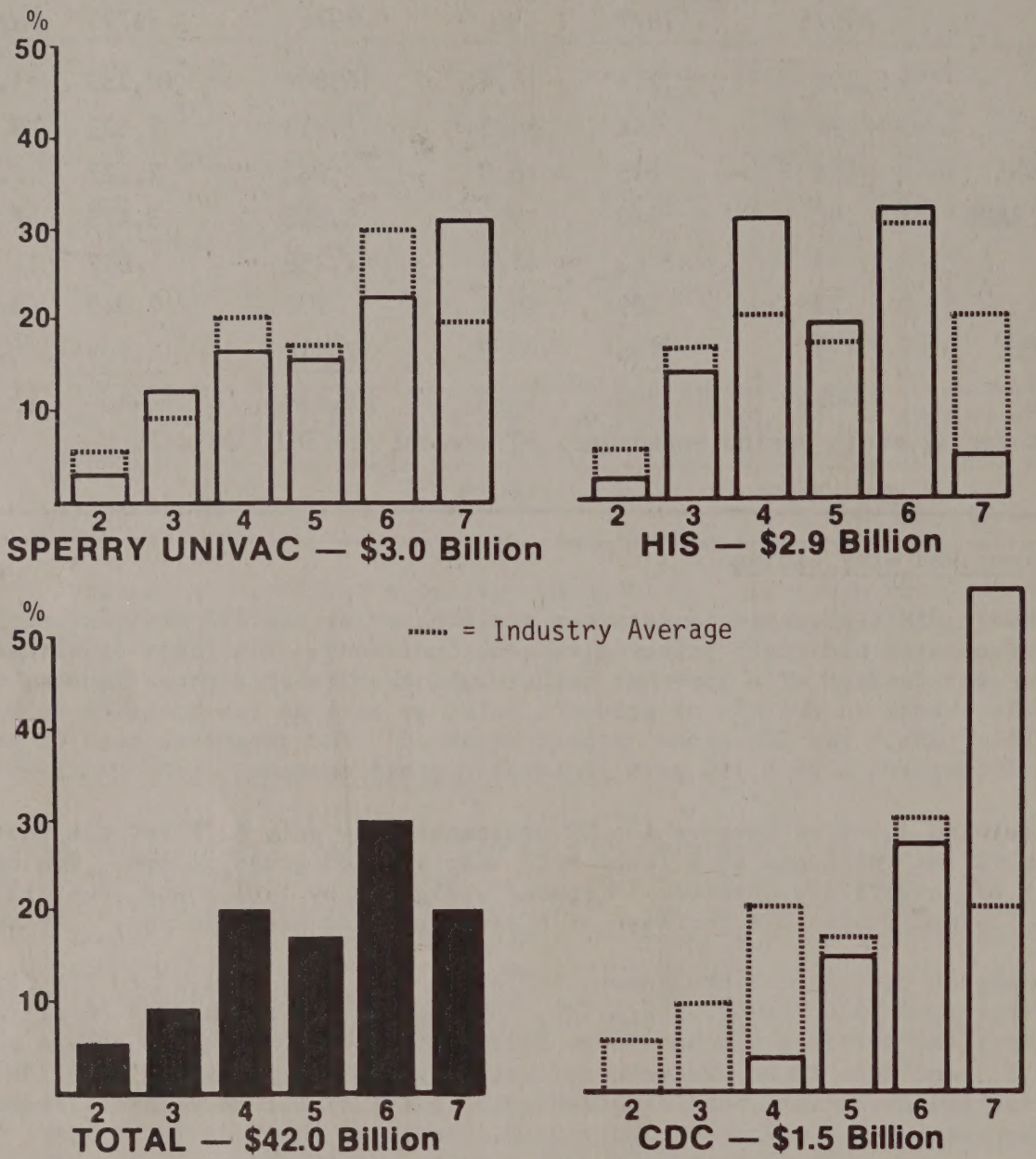

CDC, Univac and HIS added or enhanced models in the size ranges where they already have large bases, as can be seen from the above charts. For instance, HIS' Level 64 falls in Class 3; Univac's 1100/10 in Class 5; HIS' Level 66 and CDC's 175 and 176 in Class 7.

Class 2 includes systems of the size up through IBM's 3/10; Class 3, 370/115; Class 4, 138; Class 5, 148; Class 6, 158; Class 7, above a 158.

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DIFFERENCES IN FORM RATHER THAN SUBSTANCE?
HIS, CDC, UNIVAC OFFER MULTITUDE OF MAINFRAMES

In the latest round of hardware announcements, HIS, CDC and Univac apparently are concentrating on fortifying areas in which they already have sizeable installed bases. But how much is really new? Some of the salient points appear to be:

- The HIS Level 66/DPS represents a 50% price cut compared with equivalent Level 66 models. With the Level 64 and 66 pronouncements, HIS extends throughout its line the concept of on-site upgradeability.

- Univac's new 1100/10s feature better price performance and a faster memory -- 875 nsec access time -- than their predecessors.

- CDC's smaller Cyber 176 reduces by $1.1 million the price of entering the circle of Cyber 176 owners. Three models of the Cyber 175 replace the previous single model. CDC reduced by 20% prices of add-on and extended memory used in most models of the Cyber 170 line.

HIS Cuts Price at the Top

With the Level 66/DPS, GCOS users receive a substantial price cut, as did Multics users with the Level 68/DPS announced last fall (EDP/IR, Nov. 14, 1977). The moves more closely align prices of large HIS systems with those of other vendors. The cuts on the Level 66/DPS are about 51% at both the high and low ends of the 66 line. The new price for a basic 66/DPS with 1M byte is $957,215 compared with $1.9 million for the comparable 66/60. A top-of-the-line 66/DPS costs $2.9 million compared with a $6.4 million price tag on the quad 66/80. In addition, the new model is 20% more powerful than the old version, HIS said.

And Repackages the Middle

HIS made a splash emphasizing the modularity and upgradeability of the Level 6 and has adopted the same approach for the Level 64. The new 64 offering exceeds the range of the former 64/20 through 64/60. HIS also allows users to obtain different lease terms for individual pieces of equipment. Previously HIS users had to put the whole system on the same lease plan. The price tags are not new; they closely resemble those of the Level 64 forebearers.

As it did with the Level 6, HIS has instituted a dedicated sales/support force which "underscores our on-going commitment to the medium-systems marketplace and our confidence in the product," according to Richard R. Douglas, HIS' vice-president of the Marketing and Services Information Division.

The separate sales forces could indicate a trend toward the establishment of individual profit/loss centers among HIS' various product lines.

HIS offers remote maintenance for the 64, both current and future models. From remote locations HIS can diagnose and patch software and malfunctions without disturbing the customer's operation. In addition, the vendor can access a system's error log to diagnose potential failures.

Most of the peripherals are not new. However, there is a new 70M byte disk with removable packs that can be upgraded on-site to 100M bytes. The range of the disk storage remains the same as with the previous Level 64s.

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Some software features that enhance the Level 64 are:

- The ability of GCOS to handle 10 concurrent batch and/or communications jobs, double the previous limit.
- Connection of IBM 3741 and HIS Level 6s operating in a data entry facility.
- Inclusion of an optional Report Writer in the Cobol compiler.
- Applications packages for the manufacturing and distribution industries include a production scheduling and control system, an inventory management system and a sales order processing system.
- Interactive text editing and operations facility.
- The capability to access a centralized data base in a transaction-driven environment.

Univac Boosts Price Performance

Through the use of 4K MOS memory with an 875 nsec access time compared with 1.125 microsec of previous 1100/10s, Univac claims to have added performance improvements in the range of 20% to 30%. Prices of the four units introduced are about 5% higher than those of the previous 1100/10s and range from $486,675 for 786K bytes to $850,500 for 2M bytes. Univac touted the price performance advantages of the systems over the pre-fire sale prices of the 370/138 and 148. A new 1100/10 offers performance up to 1.4 times that of a 148.

Lest its current base of 1100/10 users feel left out in the cold, Univac offers a Systems Performance Enhancement package that it said will boost the performance of existing 1100/10s by 10% to 20%.

CDC's Action at the Top

CDC's smaller Cyber 176 ranges in memory size from 131K to 262K, 60 bit words and purchase prices range from $4.4 million to $5.2 million. In its minimum configuration of 131K with 10 peripheral processors, the new unit's price is about $1.1 million below that of previous Cyber 176s. The unit fits midway between the Cyber 175-300 and the current Cyber 176.

Three instead of one? CDC brought forth three models of the Cyber 175 -- the 100, 200 and 300 -- whose price and performance relative to the predecessor 175 range from the Model 100's 30% lower price and 18% lower performance to the Model 300's 12% improvement in performance at the same price. The new models range in price from $2.3 million for a minimum Model 100 to $3.3 million for the 300.

The 20% reduction in prices of add-on and extended memory should contribute to a drop in overall systems prices for most models in the Cyber 170 series.

The trend toward improved price/performance thus has pervaded the middle and upper spectrum of the product lines of not only IBM but also the other mainframers. But although CPU prices are on the decline, peripherals prices have shown little decline. Probably one reason for the lack of a price decrease is that IBM has not reduced its prices. Must everyone else stand and wait?

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• LIFTING A PAGE FROM THE PERSONAL COMPUTER marketeers' notebooks, IBM has set up selling centers for its 5110 in 22 GSD branch offices around the country. Customers may walk in, quiz the salesmen and "kick the tires" before ordering a 5110. However unlike the personal computer stores, there is a six month delivery cycle. A GSD spokesman explained that the lead time gives a first time user needed time in which t adjust to the prospect of having a computer. Many observers have been wondering how long IBM will continue to watch the increasingly active personal computer market place without joining in the game. Perhaps GSD is testing the water with this appro which certainly could be expanded to other branch offices and possibly to other prod should little brother in Atlanta choose to extend the line downward.

• DIFFERENT PRODUCT REQUIRES DIFFERENT MARKETING APPROACH -- that's what Dataprod ucts and Centronics seem to be thinking. Both printer makers that formerly concen trated on OEM sales have adopted different marketing approaches for their end user products. Dataproducts is setting up a distributor network to peddle its thermal and dot matrix printers; Centronics has signed on Hamilton/Avnet, an industrial distributor, which will handle the Centronics 700 Series and the firm's two versons of microprinter. Centronics will service the units sold through Hamilton/Avnet.

• WINSOME WYLY RECAPITALIZED and escaped the ignominy of Chapter 11. The plan to get creditors off its back was approved by senior creditors as the firm faced the gates of Chapter 11. Under the terms, about $91.5 million in debt plus interest was exchanged for about $9.3 million shares of Wyly common after a one for four reverse split and $4.1 million cash. Wyly has resumed trading on the New York Stock Exchang The fortunes of Wyly Corp. took a real nose dive when its cash-hungry communications unit, Datran, did not get on its feet as fast as expected. After the restructuring, Walter Haefner's firm of Careal AG owns about 50% of Wyly stock. Haefner has provid Wyly with funds since the Datran years. Chairman Sam Wyly commented on the recap italization: "After two years of preoccupation with survival, we can now turn our fu attention to the operation and profitability of our internationally respected compute services business, University Computing Company."

• FIRST CAME AUTOMATED TELLERS, NOW AUTOMATED TICKETING DEVICES are planned by Pacific Southwest Airlines to abbreviate lines of passengers before ticket agents. PSA has ordered from Cubic Corp. 30 ticketing devices that will accept seven varieti of credit cards that are operable by passengers.

• UNIVAC HAS REVAMPED ITS CORPORATE STRUCTURE and folded the responsibilities of the former Communications and Terminals Division, along with development and manufac turing of the BC7 and development of the 90/30 and 90/25, into a new General Systems Division. The second new division, Major Systems Division, is responsible for 90/60 and up and all 1100s. Previously the two divisions were Systems, and Communications and Terminals. The move is intended to ensure commonality in related product areas and allow flexibility in incorporating new technologies across Univac product lines. Minicomputer operations, formerly Varian, will continue to report directly to Group Vice-President Paul J. Spillane.

• PARTNER HUNGRY GENERAL COMPUTER SYSTEMS may finally be arriving at the altar after unconsummated romances with Scan-Data and then Computer Automation. Evidently General Computer's price tag of $4.5 million was a bit more than CAI wanted to pay. Telex, the current intended, said the price is about $5 million and is awaiting ap proval by General Computer's stock holders. Within the last year and a half Telex bought Terminal Communications and Gulliver Technology, maker of a small tape drive.

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• DATASPEED 40/4 IS NOT A DATA PROCESSING DEVICE . . . so sayeth the U.S. Court of Appeals for the Second Circuit, which upheld the FCC's January, 1977 decision to tariff the device as communications equipment. The Second Circuit's ruling does not appear to leave protestors, such as the CCIA, CBema and IBM, an appealable issue to take to the Supreme Court. The computer interests await, as does everyone else, a decision by the FCC's Computer Inquiry II that is attempting to define once again the boundaries between DP and communications. In the meantime, the CCIA is looking into other areas of DP where it thinks AT&T does not belong, such as software. AT&T's sale of software may be a violation of the 1956 Consent Decree, a CCIA spokesman said. The appeals court's decision makes the score 1 to 1 in AT&T's recent bouts with the courts. The Supreme Court dealt Ma Bell a blow when it let stand an appellate court decision allowing MCI to run its Execunet service (EDP/IR, Jan. 30), but this recent ruling keeps open to Ma Bell the ever-expanding market for terminals -- including those with intelligence.

• TEXAS INSTRUMENTS PATENTS A BASIC MICROCOMPUTER that it introduced commercially in 1971. The device, which incorporates program and data memory, arithmetic unit, control and I/O circuits on a single silicon chip, is the basis for TI's TMS 1000 family. TI indicated it expects to follow the same policy with its microcomputer patent as with other patents and offer licensing arrangements to others. The patent covers the basic concept of the microcomputer and applies to those made by other firms, TI said. The U.S. Patent Office awarded patent no. 4,074,351 for the device designed by TI engineers Michael J. Cochran and Gary W. Boone.

• NCC's GOING TO BE A BIGGIE. Although reports that the exhibit hall will overflow into Disneyland are unconfirmed, Afips, the organizer, has indicated a parking garage adjacent to the Anaheim convention center is being converted to provide additional exhibit space. More than 330 organizations have reserved 1,382 booths, topping the previous record of 1,146 booths in Dallas last year. In addition to space in the North, South and now West exhibit halls, NCC will feature a separate exhibit of personal computers at the Disneyland Hotel Convention Center, which offers the only space still available. Word has it that hotels/motels are already filled for the early June gathering. Thus attending throngs may become true Californians and find themselves driving 30- 45 minutes from hotels to the conference. All of which could bring back memories of the 1969 Spring Joint when Boston's hotel space proved grossly inadequate.

• IBM AND XEROX HAVE AN IRRESISTABLE URGE to meet in court. Although Xerox won the first round on one of several still pending patent infringement suits it filed against IBM in the copier arena, IBM has taken the attack in the word processing stadium. In a recent suit, IBM alleges Xerox's 800 and 850 typing systems infringe seven of IBM's U.S. patents pertaining to such features as data recording, proportional spacing, printing and margin adjustment. In the copier area, a Canadian court last July ruled that IBM's first copier infringed on some of Xerox' patents. Xerox called the word processing suit without merit and said, "In view of our successes in our patent infringement suit against IBM in Canada relating to copier/duplicator products, we aren't surprised by IBM's commencement of this action involving word processing. systems."

• WHEN IS A CALCULATOR A COMPUTER? Perhaps to avoid answering that question, HP's Computer Systems Group gathered into its fold the Fort Collins Division that makes desktop calculators/computers, formerly a part of the Calculator Products Group.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MARCH 15, 1978 o VOL.13,NO.17 P.J. McGOVERN,PUBLISHER

Rear guard or front line?

IBM PRICE CUT ON 138, 148 PROMPTS SPECULATION ON 'WHAT NEXT'

IBM lowered the purchase price tags of its 370/138 and 148 by as much as 20%, more closely aligning the machines with the price/performance parameters offered by the 303Xs. There is now more of a price margin between a two megabyte 148 and 3031. One likely reason for the move is that plug compatible makers, which traditionally offer improved price performance over the target IBM machines, were frolicking in a field without any IBM sentries to guard the lower end of the line. The 138 and 148 were more expensive than the PCMs' offerings, and there was nothing in the bottom of the 303X line to guard IBM's flank. Thus, by lowering prices, IBM has sent the 138 and 148 down to the lower pasture to do battle with the present and future PCM invaders. With the price cuts, IBM is tantalizing users to convert their leases/rentals to purchases, thus reducing IBM's risk exposure should it introduce future machines in this area. The move comes 12 months after IBM established new price/performance parameters with its introduction of the 3033 and price cuts on the 158, 168 and MOS memory.

The move elicits the question: What next, IBM? The answer seems to become two additional questions, each of which prompts a rational scenario:

- Will IBM fill out the lower end of the 303X line with smaller 303X(s) or a new (E) series machine?

- Will the 138 and 148 serve that purpose and eventually be upgraded into a future machine?

Other related questions pertaining to the entire 303X line are:

- Will IBM replace the 303X in this decade?

- If not, what will 303X upgrades look like?

History seems to support the first theory that there are more 303X(s) coming from the Giant. IBM lowered prices of the 158, 168 six months prior to introducing the 3031 and 3032. The price changes of the 138 and 148 could be a similar move. Remember the Future Systems? That terminology was scrapped in March, 1975, IBM said. But it is unlikely all the research and architecture plans were

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scrapped. Perhaps IBM came out with the 303X, which was probably relatively easy to schedule into production because it appears to lack much new technology, in order to be consistent with its previous intervals between system introductions. Thus, the 303X could be a measure to stall the public until certain devices can be brought out of the laboratory.

It's a sure bet that IBM has some goodies up its sleeve, such as Josephson Junction technology, about which it is now talking. This new technology permits a density of at least 400,000 bit/sq. in. Chips of this construction are very fast and generate very little heat. IBM estimates a 16K bit chip should have a 15 nsec access time and a read/write cycle of 30 nsec. Power dissipation for the same chip is projected at only 40 microwatts; a two megabyte memory would dissipate a maximum of 40 milliwatts, IBM calculates.

While EDP/IR is not saying we will see Josephson Junction technology in whatever IBM puts in the 138, 148 size range, the possible new machine is unlikely to be simply another 303X because that price performance area is now filled with the 138 and 148. Therefore, the E series, or whatever it might be called, is likely to give the world a good preview of what can be expected from the Giant.

But the second theory -- that IBM will stand pat with the 138 and 148 in this area -- has its advocates also. The machines have a suspicious amount -- 131K bytes -- of reloadable control store, which might be the means through which IBM would upgrade them to true 303X machine performance, a la the dynamic address translator (DAT) that was supposed to transform a 155 to a 158. Also, would IBM want to aggravate its 138 and 148 users by introducing a new machine so soon after dropping the price and encouraging users to buy their machines? IBM certainly did not make many friends among the owners of 155s and 165s when it brought out the 158 and 168 within 26 months of the previous products' announcement. The number of installed 138s and 148s is substantial and growing at a rapid pace. IDC figures showed 4,170 of these machines installed worldwide as of Jan. 1, 1978 and IDC estimates suggest that base will be slightly more than doubled by the end of 1978.

The current base of 138s and 148s is heavily oriented toward rental/lease agreements with IBM, and therefor ripe for conversion to purchased systems. For instance, in the U.S. at the beginning of 1978 about 60% of 138s and 40% of 148s were covered by such arrangements with IBM. These percentages are expected to change considerably this year. The heavy lease/rental orientation of the 138, 148 is seen when compared with the base of 158s and 168s at the beginning of 1977. Lease/rental arrangements with IBM accounted for only 20% of 158s and 24% of 168s, according to IDC figures.

Filling the price/performance gap?

From the time when IBM introduced the System/360 almost fourteen years ago, the concept of "family" has been paramont in discussing computer offerings. To explain what seems to be happening, IDC has prepared the chart (page 3) that illustrates the continuing increase in performance for a given price in major IBM offerings during the time since S/360.

The "performance" ratings used in the chart are those IDC has been maintaining over the last several years (EDP/IR Oct.21,1977). Essentially, they are based on published relationships between various models, stated on an arbitrary index basis. The vertical lines for each processor indicate the range of the system's original price over its various memory sizes.

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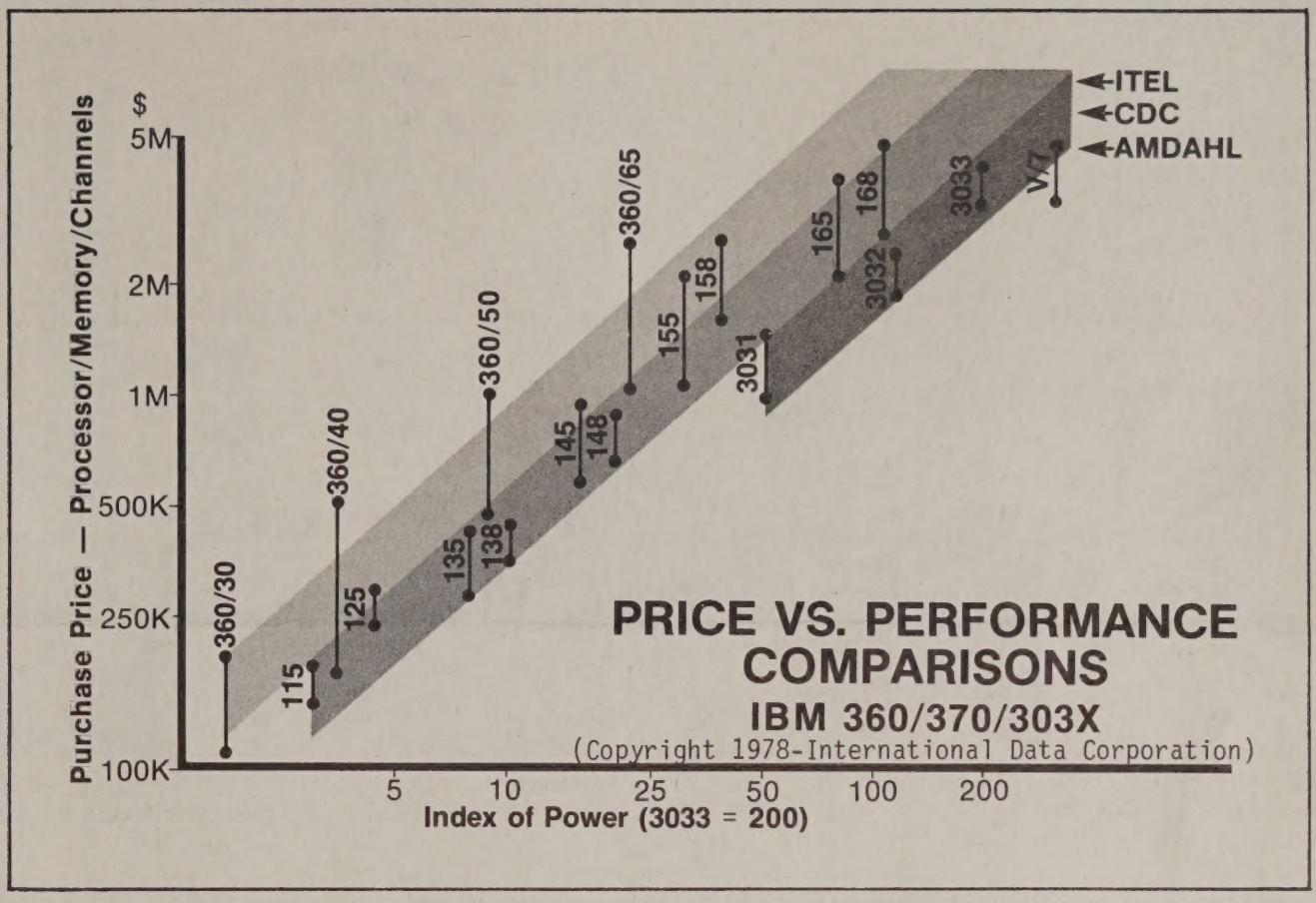

To make the chart a little more meaningful, IDC has placed gray bands through the successive generations of IBM offerings. One of the most obvious observations is the gap at the lower portion of the 303X band. And this gap now has been partially filled . . . the latest price cut for the 138 and 148 has the effect of pulling the lines for these two models vertically downward into the extension of the darkest band.

The band also serves to indicate what IBM might be planning to offer in a rumored "E Series" of new processors. One version is for five processors, the E-0 through the E-4. On the chart, these models could logically (assuming each would be about double the power of the next lower one in its series) fall in the spaces just left of and below the 155 (the E-4), just left of and below the 145 (E-3), just left of and below the 135 (E-2), below the 360/40 (E-1), and, off the chart, below the 360/30 (E-0).

The chart also illustrates the current pricing philosophy being followed by the plug-compatible processor manufacturers. In general, Itel's offerings have been across the division line between the 370 and the 303X bands. CDC's offerings are basically within the 303X zone. Amdahl's offerings tend to be positioned half a band below the 303X.

Impact on PCMs

With the latest price changes, IBM has virtually folded up its umbrella. This action is sure to cause some consternation if not some price changes by PCMs as well as by other mainframers. Because the base of 138s and 148s is still relative-

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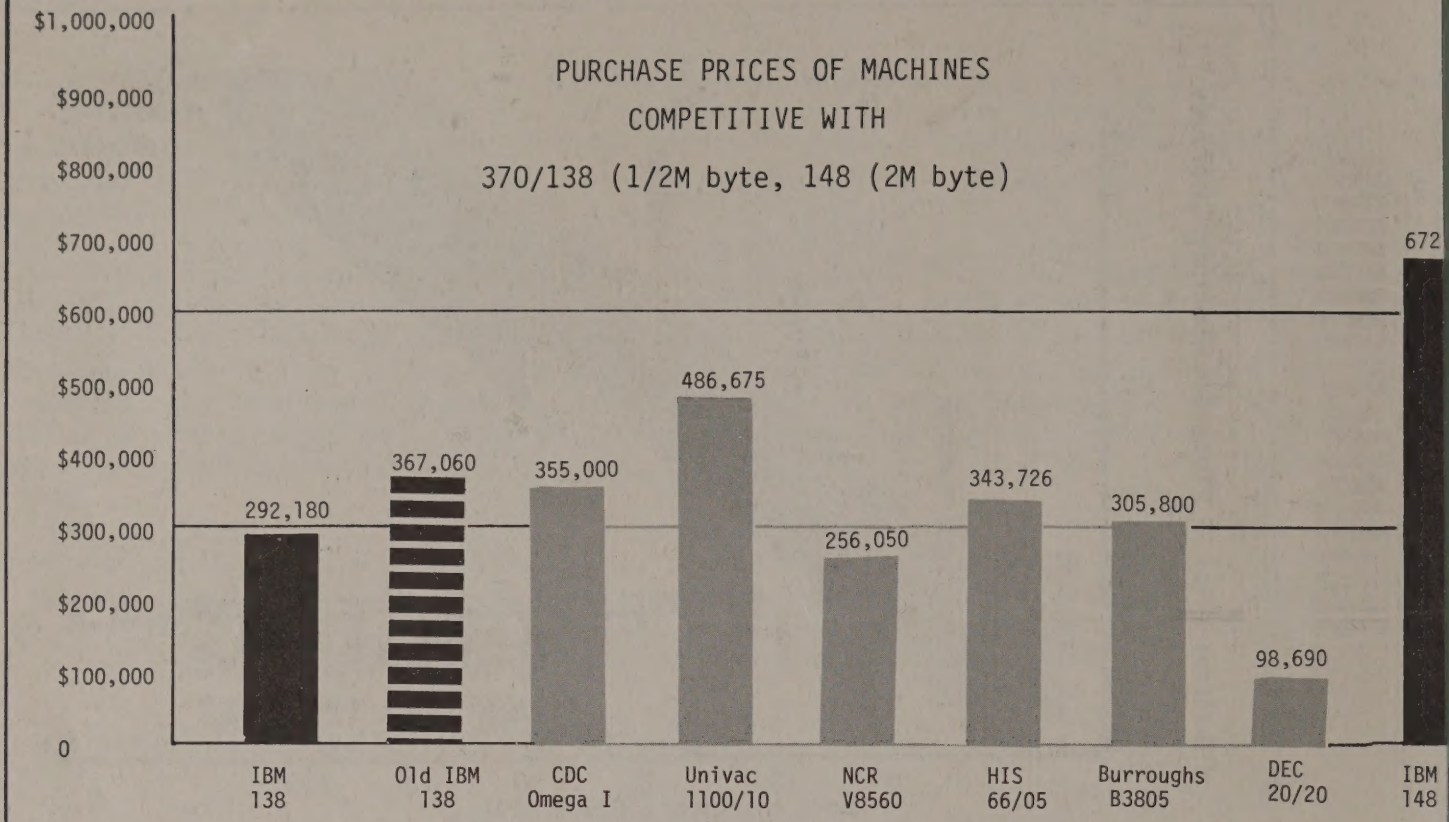

The drop in 138, 148 purchase prices aligns these machines in the low end of prices of systems posed by other vendors versus a 1/2M byte 138 and a 2M byte 148. Prices are purchase and include CPU, memory, console and power supply. The above chart does not consider performance factors. The 3031 is included for reference and includes six channels.
Some vendors' quotes include more peripherals (Univac) and some less memory (HIS). Univac prices include software; DEC prices include operating software. The low end Univac 1100/10 price includes four I/O channels, a 300M byte disk

U.S. MARKET (SIZE CLASS 6 and 7)

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	$ M in Use				1977 Units Shipped			
	12/76	12/77	%Δ	Share	Class 6	%	Class 7	%
IBM	13.3	15.6	17	76	220	56	110	57
PCM	0.1	0.3	190	1	35	9	43	22
Non-IBM	4.3	4.7	11	23	135	35	40	21
TOTAL	17.7	20.6	17	100	390	100	193	100

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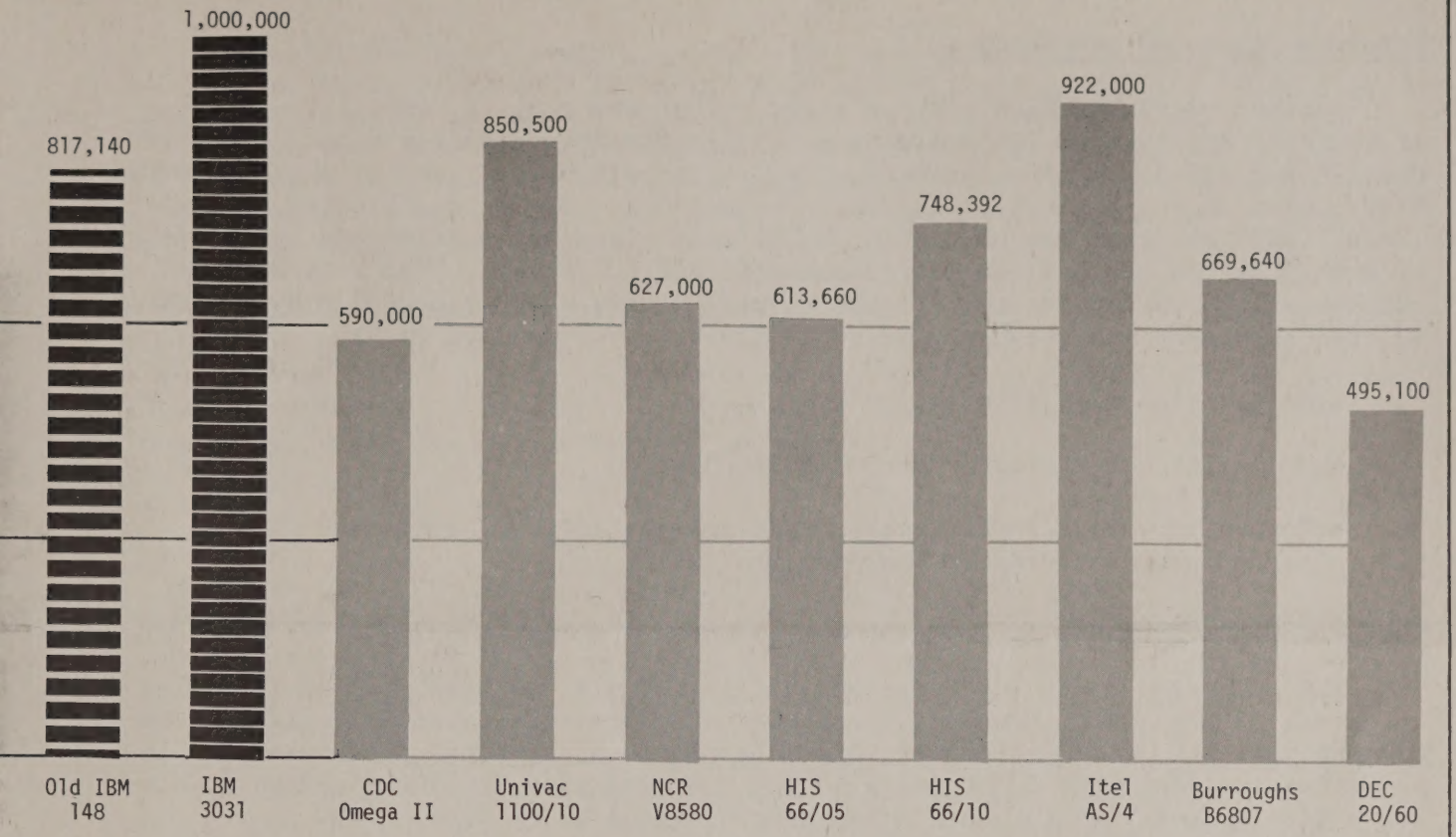

and controller and 784K bytes of memory. The high-end 1100/10 has two, 300M byte disks, four I/O channels and 2M. The low-end HIS 66/05 has 378K. The HIS machine bid against a 148 varies according to the environment. Each has 1.5M. HIS would cite a 66/05 in a timesharing, communications environment, a 66/07 for heavy time-sharing; and a 66/10 for pure batch. The B6807 has 1.6M bytes, an I/O processor and peripheral controller. DEC's 2020 has two channels.

ly small -- shipments started November, 1976 and March, 1977, respectively -- IBM concentrated its initial pricing actions in the upper end of its line where PCMs were threatening to make inroads. IDC figures show that in size class 7, which is machines of the size of 370/168 and above, the PCMs in 1977 shipped more machines than all the other traditional non-IBM mainframers combined. During 1978, U.S. shipments of machines of size classes 5-7 (148 up) should be about 1,500 units by IBM and 215 machines by PCMers, according to IDC figures.

But there have been signs of action in the 138 and 148 market also; no fewer than two PCMs have announced products and a third, Magnuson Systems, has indicated it intends to put its hat into the ring. IBM's pricing of the 138 and 148 appears to hit these makers where it hurts, on the price/performance curve. Although slight in terms of the dollars involved for the larger PCM machines, IDC projects PCMs' 1978 shipments of machines in the size range of the 138 and 148 will amount to a maximum of 2% of 138 shipments and between 2.5% and 3% of 148 shipments.

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Memory -- price or technology?

Another means by which IBM can alter prices and put its competition off guard is memory. EDP/IR sees IBM's memory pricing/technology strategy ripe for change. The 138 and 148 price moves preserved DPD's year-old price level of the $110,000/M byte seen in the other 370s and the current 303X. But little brother in Atlanta, GSD, has sent out what might be a faint signal by pricing one increment of memory on the Series 1 at what amounts to $78,000/M byte. And at least one PCM has a lower price for memory: CDC's Omega memory costs $100,000/M byte. DEC's 1M byte increment for its new 2020 costs $55,000 and uses 16K chips.

From IBM, IDC sees either:

- Memory priced as little as $75,000/M byte.
- Memory of entirely different technology at $110,000/Mbyte that offers significant performance improvement.

Projection of shipments

IDC estimates about 9,000 systems of the 148 ilk and 303X will be installed between 1977 and 1980. However, the number of processors involved could run considerably higher if IBM comes out with multiprocessor systems. The breakdown in shipments will be about 5,500 units in the U.S. and around 3,500 for foreign markets, with a four year purchase value approximating $7 billion.

The total order rate for 148 systems and 303X looks to be around 15,000 to 20,000. IBM Chairman Frank T. Cary said recently the order rate for 303X is "phenomenal. In fact, the computing capacity of the new processors on order is four times that represented by all the computers that IBM has shipped ... ever, and we've shipped a lot of computers." With delivery dates extended, IBM is making efforts to ship the machines out its doors as fast as possible. Many plants are working three shifts; IBM added 18,000 employees in 1977.

One should remember, however, that an order does not necessarily a shipment make. For, when the prices of 370s drop, as they undoubtedly will when 303X become available, users may find the 370s to be attractive alternatives to the higher ticket, albeit higher performance 303X. In addition, 370 users under long term third party leases can only get out of them early if the lessor places the 370 elsewhere. If the going market rate is too much below the lessor's book value of the system, the lessor will be reluctant to transfer the machine and the owner may find himself living out the full term of the 370 lease.

Whither the 303X future?

A successor to the 303X is unlikely within this decade, IDC believes, although such announcements are likely about 1981-1982. In the meantime, IBM will pursue a policy of containment, replete with appropriate mid-life kickers, that will probably leave the independents between 15% and 35% of the market. After all, over 85% of a market is dangerous, even if one's chief counsel is a former attorney general and the market is one's own equipment. Probable methods of containment:

- Multiprocessor capability -- not just the garden variety, but a scheme whereby the user can tightly couple several main processors and intermingle front end and back end processors is likely.

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o Microcode, a necessary glue in sticking one or more of these processors together, represents one more chink in IBM's effort to build a wall of containment to keep the PCMs from too liberally using IBM's software. The more microcode IBM embeds in its machines, the harder it will be for the look alikes to remain true look alikes. As a harbinger of things to come, IBM's MVS/SE will not run on Amdahl machines. Look for more software that's not easily transferable to other machines.

With the decreases in hardware prices, IBM's got to make its shekels somewhere. There is a substantial plug compatible market, so peripherals aren't exactly the prime area in which to reap future profits -- unless assisted by microcode. Look for software to bear more of the burden of systems revenues as unbundling continues in the realm of operating software.

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DEC BROADENS DECSYSTEM 20 LINE; LOWER END 'LOOKS LIKE A MINI'

Digital Equipment Corp. added the high and low ends of its Decsystem 20 line with the 2020 and 2060 which use semi memory. The 2020 mainframe, which looks like a mini, may herald an era when mainframes are no longer power-hungry, environment-sensitive machines. Using 16K chips, the 2020 with CPU, memory and controllers operates on standard 110V wiring and dissipates only 1,400 W -- the same as a hair dryer. (However, a load of peripherals may boost power requirements.) The system can be incorporated into standard business office environment, eliminating the expense of a computer room. Time was when minis touted these attributes in contrast to mainframes.

The 36-bit word length 2020 is a mainframe because it is designed to handle a variety of tasks rather than specialize in one particular area, DEC said. The system uses the TOPS-20 operating system as does the new 2060, but TOPS-10 will be available first on the /20 and then eventually on the other 20s. The 2020 offers concurrent interactive time-sharing, multi-stream batch and transaction-oriented processing.

But DEC has not completely abandoned its ways as a mini vendor; plans call for marketing on both an end user and OEM basis. A key target OEM area is services firms which will install the 2020 rather than minis at customer sites. The machine is also expected to find itself at home as a distributed host where interactive capability is desired and in offloading mainframes in areas such as program development.

Memory size of the 2020 ranges from 512K bytes to 2M bytes; disk storage from 67M bytes to 1.4 billion bytes. There are up to four tape drives, 32 asynch lines as well as two synchronous lines, printer and card reader. Software is compatible with the rest of the 20s and DEC's DBMS is available on the 2020.

Prices of the 2020 start at $15,000. In pricing its memory, DEC does not appear to have made the add-on market very attractive for independents. A 1M byte increment of 16K chips goes for $55,000.

At the top of the line, the 2060 will also use MOS memory, in contrast with the 2050's core, and contain an "advanced" version of the KL CPU used on other 20s. System prices start at $610,000. The 2060 can handle up to 80 concurrent users vs. 64 on the 2050; maximum main memory is 5M bytes -- 4M of MOS and 1M of core.

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• FROM OUT OF THE JAWS of the House Rules Committee, the CCIA, with some help, snatched a proviso pertaining to electronic mail from HR 7700, which calls for the Post Office to boost its spending for R&D to 2% of its entire budget the previous year. Charles H. Wilson, (R-Calif.), co-sponsor of HR 7700, deleted the portion pertaining to electronic mail prior to review and subsequent passage of the bill by the Rules Committee. Electronic mail is thus still fair game for private companies.

• ELECTRONIC MAIL HAS ALREADY APPEARED, in case you've been too busy looking in your conventional mailbox to notice. Comet, a system from Computer Corporation of America, Cambridge, Mass., runs on a PDP-11 with the RSX-11M operating system and has an X.25 interface available for connection with packet-switching nets. Comet is available as an inhouse system or as a subscription service for trial use. Features include answering, filing, sending and retrieval capabilities.

• HONEYWELL'S 66/85 DIES ABORNING. Although HIS indicated it will continue work on current mode logic (CML) technology, CML's lack of cost effectiveness was indicted as the culprit in HIS' decision to abort the 66/85. The large-scale system was announced in January, 1977. HIS and CII-Honeywell Bull have been working jointly on CML; HIS' Large Systems Division in Phoenix will continue ongoing CML circuit and micropackaging development.

• JUST IN THE NICK OF TIME to uphold its first quarter delivery dates, IBM rolled out of its Poughkeepsie plant first customer shipments of a 3033, 3032 and 3031. The recipients are: Singer Co.; U.S. Air Force's Data Services Center, and The Credit Life Insurance Co., respectively.

• THE FCC AND THE COURTS CAN'T SEEM TO AGREE if AT&T is entitled to a monopoly in long distance phone service. Shortly after the Supreme Court upheld an appellate court's decision that appeared to allow MCI to run its Execunet service, the FCC in a six to one ruling said AT&T does not have to make additional connections of competitors' non-private lines. The appeals court indicated the FCC should authorize the Execunet service unless it decides that the AT&T monopoly is in the public interest.

MCI is fighting the FCC decision on two fronts; it has asked the FCC to review its decision and has petitioned the same court of appeals to "enforce its mandate." MCI expects a response from the court could come before the end of March. Execunet, the backbone of the profitable MCI, needs AT&T local loops to link its customers with its service.

• SUPERMINIS VARY PRICE/PERFORMANCE FACTORS. HP chopped $11,000 off the U.S. price of every 3000. Base prices of the 3000 Series I and II are now $64,000 and $99,000, respectively. The company cited decreasing component costs, especially semiconductor memory parts, and increased shipping volume -- it recently shipped its 1,000th HP Series II.

But HP was not alone. Prime Computer Inc. created a 350 which it said brings the capabilities of the 400 and 500 to the price range of the 300. Using a subset of the Primos IV operating system, the 350 has data base management capability, offers up to 2M bytes of virtual vs. the 300's 128K and can handle user programs up to 768K vs. the 300's 128K limit. The main memory size of the machines is the same, 512K, as is the number of terminals supported, 31. The 350 CPU with 64K costs $35,000. Typical 350 price is $100,000-$150,000.

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Competition grows in Japan: Page 3

IBM BRINGS MULTIPROCESSING TO 3033 WITH PRICE/PERFORMANCE IMPROVEMENT OVER 168MP

IBM's announcement of the multiprocessor version of its 3033 was no surprise; the accompanying price tag may well make it a bargain for IBM's community of MP users. In addition to two processors, the 3033MP requires some connecting apparatus and a special device called a 3038 -- at an additional cost of almost $400,000. But the 168 version required $670,000 worth of extra gear.

Thus, the pricing seems at least consistent with the overall improvement in price/performance achieved when moving from a 168 to a 3033. For instance, on IDC's performance scale where the 3033 is rated 200 (EDP/IR Oct.21,1977), the MP version would have a rating of 334 versus about 179 for the 168-3MP. Price difference is much less: $7.61 million for a 12M byte 3033MP system versus $6.18 million for a 168-3MP with only half the memory.

So this looks like a good deal for IBM's multiprocessing users, and should keep the base happy. It also may serve to prevent some large users from straying into the Amdahl fold.

The whole announcement may be as much a salve for existing MP customers as anything else. IDC estimates there are well over 100 168MPs worldwide and about twice that many 158MPs worldwide; these are important customers that IBM cannot ignore. Having an MP system at the top of its line may serve to prevent users from thinking Amdahl is the place to go after they outgrow their 3033s. In the face of a tremendous backlog of 303X orders, IBM is quoting third quarter 1979 delivery for the 3033MP -- quite some time away as announcements of price cuts and/or new product tweaks start to come from IBM on an almost monthly basis.

Looking ahead, this logically is not the end of IBM's offerings at the high end of its range. What is most likely is more uses for the 3038 -- a role as a connector for several 303X processors and perhaps some other, more specialized attached processors. IBM in the past has shown some affinity for the concept of specialized processors. It has an array processor as well as attached processors and MPs for its 158 and 168. Look for more such products in the future. If, as some suggest, IBM is becoming more committed to the MP concept, it is likely that 303X users will be able to intermix different CPUs in an MP configuration.

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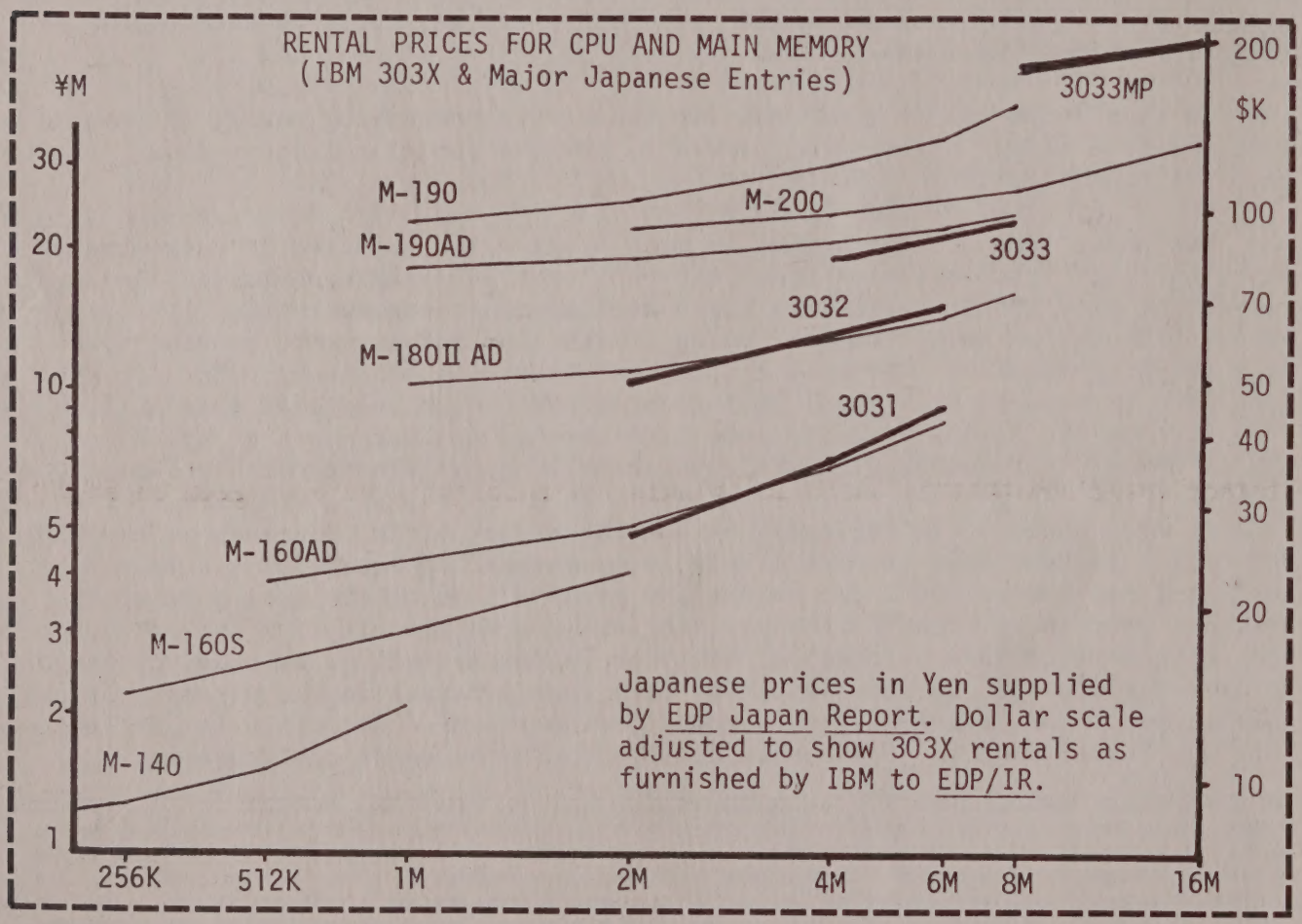
Some large IBM users have loosely coupled their 370s with Amdahls under IBM's Job Entry System. Granted, loose coupling is not multiprocessing. It simply links the systems, requires two operating systems, and provides no sharing of memory and channels; the JES, however, balances the load and handles scheduling. But it is possible now, and Amdahl reports that 15 to 20 of its CPUs are linked with 370s, at least one of them in a multiple-370 configuration.

With the 3033MP, all memory is available to each of the processors. One processor can support "major portions of the system's workload" and use the other's channels while the other is out of service for testing or maintenance, IBM said.

Looking at the cost of the MP version, there is the basic $5,500 difference in price between the uni- and multi-processor, with on-site upgrades being offered. The 3038 communications unit costs $369,000 and then there's $20,000 for two 5050s needed to add MP capability to the power and coolant units, ergo the $400,000 difference in price between two uniprocessors and an MP configuration.

Comparing the smallest multiprocessor (8M bytes) with the largest uniprocessor, (8M bytes), the difference in purchase price is slightly more than might be expected. The MP, at $7.16 million, costs 1.87 times the UP. This price difference does not quite match the stated performance improvement, but flexibility, reliability, and capacity are improved. Prospects for this option are at least as good as the 7% to 10% of the installed 168 base that opted for the MP version. Prices for the MP range to $8.05 million for a 16M byte system; the incremental cost per 2M byte of memory is $225,000 or $220,000, depending on the size of the processor.



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JAPANESE DP FIRMS PLAN NEXT ROUND AS TARIFF BARRIERS DIMINISH

Japanese DP firms are preparing to play a more competitive game in reaction to Japan's liberalization of restrictions governing imports and to the new level of price/performance embodied in IBM's 303X line. Japan has cut tariffs on imported computers to 10.5% from 13.5% and on peripherals to 17.5% from 22.5%. In addition, the government pledged to increase its purchases of foreign computers. Until now, Japanese makers have held at least 94% share of the government sector's EDP business. The net result of these two actions for U.S. firms should be an increase of at least 1% in the value of the total Japanese installed base between 1977 and 1979 -- from 42.5% to 43.7%. Current Geneva talks could lead to lower tariffs.

Although the liberalization moves should enhance the competitiveness of foreign computers in the Japanese market, any gains by foreigners will be made only through some very clever combination plays because the field is very competitive and becoming more so. The Japanese makers are:

- Pursuing the IBM market with mainframes and peripherals.
- Unbundling software.
- Increasing the use of high technology.
- Improving price/performance throughout the range of systems.

Despite the Japanese recession, or perhaps because of it and the search for improved price/performance, large users still seem anxious to have the latest models. The value of shipments rose an average of 19.2% between fiscal years 1975 and 1976 to $3.072 billion and is projected to exceed $4.2 billion by March, 1979.

But the value of retirements has also risen sharply, indicating an increasing number of large users have been migrating to the newer, more powerful machines. In fiscal 1976, the value of large-scale computer shipments rose 24% to $1.457 billion but retirements in that size class were valued at $676.2 million, three times as much as in fiscal 1975. Retirements accounted for 62.5% of total shipments during fiscal '76, resulting in a gain in installed base of only 12% -- the lowest percentage growth in installed base figures in the last 15 years. The base is expected to grow at between 13% to 14% during fiscal 1977 and 1978 with a net add to shipment ratio of between 35% to 38%. With the high rate of returns and the apparent lack of a market for used machines, at least one large U.S.-based lessor doing business in Japan is thinking of shipping used 370s from Japan to the U.S. and European markets. The conversion rate is $1 = ¥238.

PCM market growing

The Japanese government began in 1972 to heavily subsidize development of CPUs to compete with 370s. Fujitsu and Hitachi joined forces in the spring of 1972 to develop the M series with systems in the ranges of the 145, 158 and above the 168. The machines currently have their own operating systems rather than relying on IBM's as do the Americanized versions of the Hitachi M180 (Itel AS/6) and the Fujitsu M190 (Amdahl 470V/6). However, the Japanese units were designed to be IBM compatible and probably have the capability to be compatible on an operating systems level if they do not now offer this feature.

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VALUE OF INSTALLED BASE BY INDUSTRY
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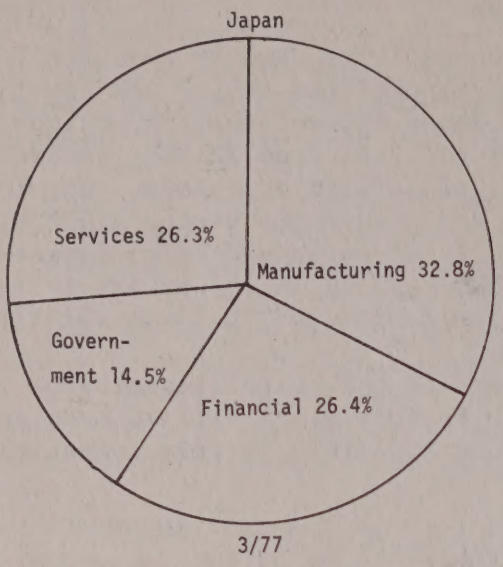

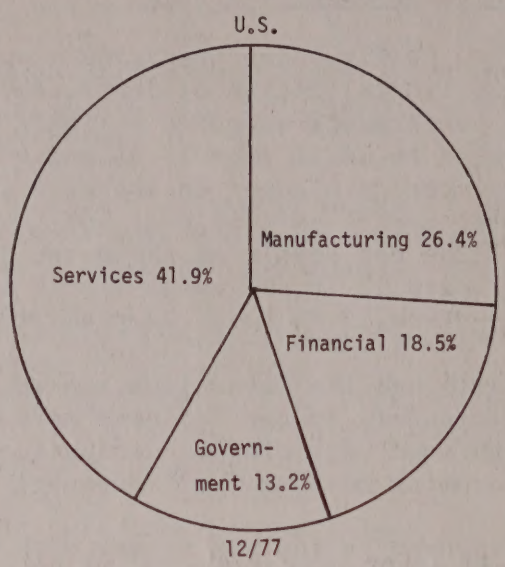

The trend toward IBM-oriented CPUs means an expanded market for plug-compatible peripherals as well as for CPUs. When IBM's 303X line eliminated the 20% to 30% price advantage of domestic makers' products, Hitachi and Fujitsu countered with new large computers, enhancements to existing lines and price cuts.

Fujitsu has unveiled its own super large computer, the M-200, and enhanced its M-160 and M-180 -- now called M-160AD and M-180II AD -- with 16K bit memories. These compete directly with the IBM 3031 and 3032, according to Fujitsu. In addition, the company cut the price of the M-190 by 20%. Fujitsu's approach with the M-200 seems similar to that of IBM and its 3033MP. The M-200 is said to be from 1.5 to 1.8 times more powerful than the M-190. The system offers multiprocessing capability for up to four processing units with main storage capacity from 2M to 16M bytes and up to 16 I/O channels per CPU. Monthly rental is from $147,000. The logic in these machines is 100 gate/chip.

Hitachi's new large-scale offering, the M-210, expected by June, should have 400 gate/chip logic and 16K memory. Hitachi claims the M-210 will offer more powerful multiprocessing than the M-200 and will support more powerful MVS at a price only slightly higher than that of the M-200.

Fujitsu has been marketing its M-190 and the M-180II to IBM users. Should IBM's 303X shipments -- slated to begin by June -- fall behind schedule, the 370 base is expected to become a prime target for these Fujitsu machines. Tokyo Marine and Fire Co., a large insurance company, installed an M-190AD last November; prompt delivery was reportedly one of the key reasons for the system's selection, in addition to its compatibility with IBM. The firm is also awaiting delivery of a 3033 and a Univac 1100/80. It has been using a 370/158 and 155 and an 1110.

But just as Fujitsu has its eyes on IBM's base, the reverse may also be true. Fujitsu has a base of about 1,300 units of its 230-"5" series that cannot migrate directly to the M series. These represent a likely target for IBM and Hitachi, both of which are expected to announce replacements for the 370/115 and 125. However, the 1,200 unit base of the 230-"8" series can migrate to the M series. Fujitsu's M series computers are estimated to account for less than 20% of that

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GENERAL PURPOSE COMPUTERS INSTALLED

March, 1976 and March, 1977
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Size	Mfr.	March, 1976 Sets	March, 1976 Value (¥ Million)	March, 1976 Share/ Sz/Cl.	March, 1977 Sets	March, 1977 Value (¥ Million,	March, 1977 Share/ Sz/Cl.	%± Value 76-77
	Jpn.	1,177	643,085	48.3	1,301	741,605	48.8	15.3
Large	For.	876	689,697	51.7	931	777,283	51.2	12.7
	Tot.	2,053	1,332,782	100.0	2,232	1,518,888	100.0	14.0
	Jpn.	4,502	444,328	70.9	4,800	476,703	71.9	7.3
Medium	For.	1,453	182,781	29.1	1,474	186,145	28.1	1.8
	Tot.	5,955	627,109	100.0	6,274	662,848	100.0	5.7
	Jpn.	7,053	137,803	73.3	8,721	164,261	73.4	19.2
Small	For.	2,274	50,272	26.7	2,897	59,503	26.6	18.4
	Tot.	9,327	188,075	100.0	11,618	223,764	100.0	19.0
TOTAL	Jpn.	12,732	1,225,216	57.1	14,822	1,382,569	57.5	12.8
	For.	4,603	922,750	42.9	5,302	1,022,931	42.5	10.8
	Tot.	17,335	2,147,966	100.0	20,124	2,405,500	100.0	11.9

Large = $ 1.1 million or more; Medium = $168,000 - $1,045,800;
Small = $42,000 - $163,800

company's total annual computer shipments. Hitachi's M-180, M-170 and M-160II probably account for over 25% of that firm's installed base.

Hitachi has recently placed more emphasis on selling its M series as IBM replacements; previously the company's primary intent was to upgrade its Hitac 8000 series. It expects to get orders for nearly 1,000 M-150 medium scale systems over the next five years.

Peripherals activity

Both small and large users are becoming increasingly receptive to mixed vendor systems, reflecting sensitivity to price and also disillusionment with the free consulting services usually offered by suppliers to single vendor sites. Hitachi and Fujitsu have set their sights on being large plug compatible equipment manufacturers and are expanding into the peripherals realm. Tape and disk drives were the first plug compatible peripherals to gain acceptance. The market for interactive terminals is expected to start growing.

Entries in the 3350 marketplace are becoming numerous. Participants are: Nippon-Memorex, Storage Technology Corp., Itel Corp. and Nippon Peripherals Ltd.

Fujitsu, which has been concentrating on its mainframe business, is expected to beef up its activity in the peripherals and terminals areas in the near future. It is exporting two 6,250 bit/in. tape drives to Memorex and is reportedly developing intelligent terminals to be used for its Fujitsu Network Architecture that is said to be compatible with IBM's SNA.

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COMPARISON OF IBM-TYPE PERIPHERALS
(Copyright 1978 by International Data Corporation)

Peripherals in Japan			Japanese Peripherals in U.S.			
Vendor	IBM Type	Vendor Model	Maker	IBM Type	U.S. Vendor	Model
Hitachi	3800	H8197	NPL	3350	Calcomp	
Nippon-	3330	3670		3340	Memorex	3640
Memorex	3350	3650	Fujitsu	3420	Memorex	3226
Itel	3330	7330-10/11				3228
	3330/3350	722012				
	3350	7350				
STC	3350					
NPL	3340-type	NP20				
	3340-comp.	NP24				
	3350	NP25				

Hitachi is also eyeing the terminal market and is expected to announce a T Series terminal that is said to be competitive with IBM's 3770. That terminal will be one of the results of a joint development project between Hitachi and Control Data Corp. from 1975 to 1977. CDC in the U.S. is continuing development work on a product expected to stem from this collaborative effort. In other areas, Hitachi has announced an IBM 3800-type non-impact printer, the H8197, which it says works under IBM operating systems.

Government's helping hand

The Japanese government is implementing several new policies to bolster the domestic manufacturers. These include:

- An increase in the reserve system through which makers buy back returned machines from Japan Electronic Computer Co. (JECC), a consortium established to facilitate leasing for Japanese DP makers.
- Flexible pricing in the JECC system.
- Inclusion of software prices in the JECC schedule.
- Investment credits for computers.

The high rate of returned machines burdens domestic makers that lease machines through JECC because they are obliged to buy back the returns at residual book value. Currently they are allowed to reserve 20% of their annual computer sales for losses from the repurchases regardless of the number of computers they rent through JECC. The Ministry of International Trade and Industry (Miti) April 1 instituted a sliding scale method whereby a supplier can reserve over 20% of its annual sales for future repurchases. The extent to which manufacturers rely on JECC varies widely. Fujitsu funnels 27% of its sales through JECC vs. Hitachi's 3%.

Miti has allowed flexibility in JECC prices thereby acknowledging the competitive nature of the marketplace. Previously, JECC's rules permitted no adjust-

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ment in prices once a piece of hardware was registered on its list -- a practice inconsistent with the price cutting that is occurring in the marketplace.

JECC has listed prices of software in efforts to make the public aware of the trend toward separately priced software. Japanese makers have traditionally bundled software and services. The JECC price schedule now includes program products and services of all makers except Oki. JECC does not handle any part of the transactions for software -- that remains between user and vendor -- but listed the prices to accustom users to the idea of unbundling.

Miti has adopted a 10% investment tax credit for purchased computers, effective April 1, to promote EDP purchases.

Despite the reduction in tariffs, obstacles still remain, such as the time and expense required to process paperwork for customs clearance.

Government aid to the computer industry is not new. In addition to subsidies for the development of semiconductors and software, manufacturers were directed to collaborate in development of products competitive with the 370 line. Fujitsu and Hitachi created the M series; Nippon Electric Co. and Toshiba the Acos Series 77; Oki-Mitsubishi the Cosmo. The government mandate called for machines offering better price/performance than 370s and also more real-time capabilities.

Americans uneasy about imports

While American mainframers have begun to talk about the possibility of direct competition in the U.S. with Japanese machines, American semiconductor makers are shouting warnings of the impending deluge of semi products and the potential ruin of that industry. National Semiconductor Corp. President Charles E. Sporck observed, "It appears that Japan already ships more semiconductors into the U.S. market than American companies ship into Japan. I find this an ominous trend." He has asked the U.S. government to initiate and enforce free trade rules for Japanese products.

Pointing to weakened U.S. industries such as steel, calculators and motorcycles, Sporck commented, "Japan's prime target today is the data processing industry. Domination of the semiconductor market in the U.S. is only a part of an overall strategy that intends to gain control of the computer industry" in the U.S.

On the mainframe front, Hitachi supplies Itel's AS/6, which resulted from a joint development project during which Itel rendered the M180 compatible with IBM systems on an operating systems level and added features and performance enhancements. The Hitachi machines are not compatible with IBM machines at the operating systems level but rather embody the RCA approach to IBM compatibility that lets the user transfer his application programs, according to Itel. Hitachi is most likely a potential supplier to Itel of the future M-210 multiprocessor as well as smaller machines below the two made for Itel by National Semiconductor.

Not to be overlooked is Fujitsu, which supplies Amdahl with much of its systems components. Fujitsu's exposure to the American market via Amdahl may have whetted the Japanese firm's appetite for American business. Both Fujitsu and Hitachi are savvy about IBM software. They can be expected to aggressively pursue the IBM market worldwide. However, in the U.S. market for large systems they probably will content themselves with the role of supplier to American firms.

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• STORAGE TECHNOLOGY CORP.'S NEW COMMUNICATIONS subsidiary, STC Communications Corp., unveiled its first product, the COM2, a voice multiplexer and concentrator that enables five private lines to be functionally equivalent to nine when handling voice. When data is transmitted, one entire line is occupied. However, the system will revert to the expanded capacity after the data transmission is ended. The system costs $60,000 to $80,000; target custommers are phone companies, government and volume users of telephone systems.

• ARRAY PROCESSORS HAVE BEEN USED WITH MINIS for some time, but Data General decided to grab a piece of the market itself and introduced the Eclipse AP/130 that combines an Eclipse S/130 and a floating point array processor with 8K bytes of 200 nsec memory. A microprogrammed control processor is driven by 132-bit control words with a 200 nsec microcycle. Array Processor Software is included in the system cost, which is under $60,000 for an entry level laboratory AP/130 with 128K bytes.

• NAKED MINI DIVISION PUTS CLOTHES on a system and calls it "the basic desk." Destined for systems houses selling turnkey office computers, the Computer Automation system includes Basic software, 16-bit mini, dual floppies or controller for a 10M byte drive, CRT and I/O system. Prices in lots of 25 start at $11,700.

• IBM, XEROX SEEK HELP FROM OTHERS in exploring territories unfamiliar to them. IBM and Comten signed a non-exclusive patent-licensing agreement primarily for the use of Comten's patents for computer performance, measurement and evaluation products. IBM will pay Comten $2.4 million for a five-year, royalty-free license permitting each company to conduct its present and future business without liability to each other. Xerox's Data Systems Division signed a research and development contract with Quantor to test the feasibility of integrating its microfilm technology with a possible future Xerox product. Initial funding by Xerox is about $50,000; the program could run 18 months and cost Xerox up to $450,000.

• HONEYWELL PREPARES TO PUT BOTH FEET INTO JAPAN through an agreement with its distributor, Mitsubishi Office Machinery Co. Ltd. (MOM) to establish a jointly owned Japanese corporation, Honeywell Information Systems (Japan) Inc. Honeywell would own 80% of the new unit, which would acquire those parts of MOM that handle distribution and service of Honeywell gear. The plan is subject to approval by the Japanese Government.

• AS U.S. VS. AT&T PREPARES TO MOVE TO STAGE ONE, exchanging documents, Southern Pacific Communications has slapped Ma Bell with an antitrust suit seeking up to $200 million. The suit charges AT&T and its units with conspiring to establish "unreasonably low and unjustified rates" for Bell services competing with SPC and to refuse interconnections between SPC and Bell companies.

• IBM TAKES THE DEFENSE in Memorex vs. IBM in San Francisco after Judge Samuel Conti denied most of IBM's motion for a directed verdict. This is the first major antitrust case in which IBM has had to present a defense to a jury; its only other experience was in the recent trial of a case brought by Forro Precision, but that case focused on allegations that IBM interfered with its business. IBM isn't off the hook yet in the Calcomp case; an appeals hearing is slated for May 2.

• CORRECTION -- The price of Digital Equipment Corp.'s minimal Decsystem 2020 is $150,000 (EDP/IR, March 15).

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" APRIL 21, 1978 • VOL.13,NO.19 P.J.McGOVERN,PUBLISHER

SOFTWARE REMAINS THE KEY TO SERVICES FIRMS' HARDWARE OFFERINGS

At least three services firms ostensibly have entered the hardware arena with recent announcements of mainframes and megaminis linked to their networks and with turnkey minicomputer systems.

But their traditional areas of strength -- software and communications expertise -- are the crux of their offerings. These moves are not simply service companies entering the hardware business; most emphasize that because of their software, they should not be considered simply as hardware vendors. Indeed, the recent activity is quite different from the role of mini distributor adopted by numerous service bureaus. Within the last month, the following moves were made:

- Xerox Computer Services is beefing up its terminals by adding the 1350, which is "similar" to the 3200 processor.
- Keydata Corp. is selling turnkey packages wrapped around Data General minis to small distribution industry companies.
- ADP is providing "Onsite" Decsystem 2020 mainframes as part of its services offering.
- NCSS is offering a processor -- made by a new firm, Two Pi -- that emulates 370 software.

The large services companies are capitalizing on their accumulated software expertise for a particular type of hardware or industry. The moves represent a possible incursion into the territories of packaged software vendors and specialized common carriers.

The offerings by ADP and NCSS may give distributed data processing the shove it seems to need to put it into the realm of acceptability by making it a workable concept. These vendors are providing not only systems that can interact with each other and also with larger systems at the vendor's central site, but also communications in the form of packet switching.

When combined, the four announcements, each with its own angle, create quite a splash. Do they make a trend? Probably. For although none admits the move is a defensive posture to protect its base, each acknowledges it is

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GROWTH OF SERVICES SECTORS 1973 - 1982
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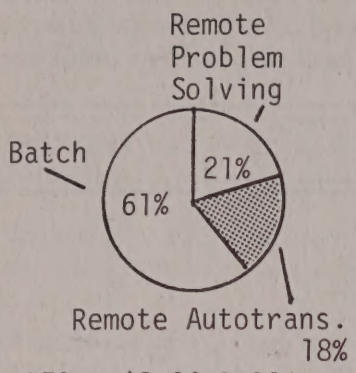
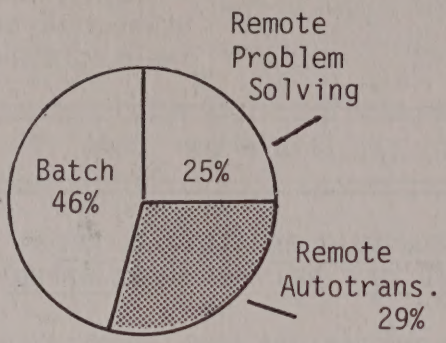
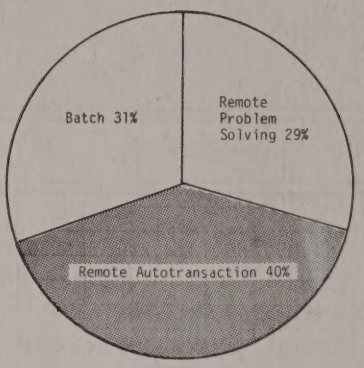


1973 - $2,24 Billion



1977 - $4,185 Billion



1982 - $9 Billion

PROCESSING SERVICES TO GROW AT COMPOUND RATE OF 17%
FROM $4,185 BILLION IN 1977 TO $9 BILLION IN 1982

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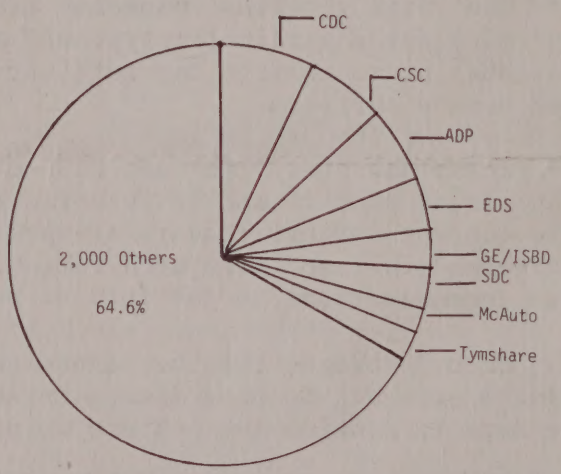
$ Million	Carry-In Batch	Remote Batch	Interactive
Problem Solving	$65/(-8%)	$410/24%	$635/17%
Transaction Processing	$1,830/8%	$415/33%	$430/14%
Data Base Inquiry	$40/10%	$15/19%	$345/26%

With remote services accounting for an increasing portion of services industry revenues, software is playing a larger role in generating revenues.

Remote problem solving and remote autotransaction services accounted for over half the services industry's revenues in 1977 and will continue to outpace the growth of batch.

Big firms are getting bigger through acquisition. Eight companies, each with revenues of $100 million or more, garnered over 30% of the market in 1977 while 2,000 others shared the rest of the $4,185 billion pie.



1977 - $4.185 Billion

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openly seeking customers from others' bases. Those who aren't supplying hardware as added enticement to their software and communications products may feel they need to. Itel, which already peddles plug compatible CPUs in the form of its AS line, is likely to move its services operation in a direction similar to that of ADP and NCSS. Software houses also may feel the need to rally and offer hardware along with their software in order to play on the same field as the services firms. Informatics is offering its cataloging data base for libraries via a bundled turnkey mini system, Mini Marc. The industry is already showing signs of putting the ingredients into a melting pot; whether the result will be a homogenized mixture or a witches brew remains to be seen.

Unbundled operating systems?

Could the NCSS and ADP moves of putting their operating systems out in the field, albeit on machines bearing their name, presage selling operating systems as a separate product? NCSS is thinking of selling its operating system but has not decided on a price. VPS will probably be available as a separate product by spring of 1979, a spokesman said. More such action is likely to occur when and if IBM unbundles its operating software. Thus the scenario could look like this: plug-compatible CPUs sporting operating systems compatible with IBM's. How far out of the IBM fold are users willing to go?

Software plays an increasingly large role in generating services firms' revenues. The relationship between software houses and services firms may be entering a more uneasy stage than previously because the lines are blurring. Time was when software houses' customers were those with inhouse computers and services firms' customers were those without computers or whose systems could not, for a variety of reasons, handle specialized applications. But now it would appear they may find themselves fighting over the same prospect, one who was overlooked by the software house because of the lack of an inhouse CPU. Through their efforts to promote the concept of onsite CPUs, services firms are simultaneously:

- Creating prospects for software houses;
- Becoming outright competitors of software houses.

Meeting the hardware threat

What to do about minis has been a perennial topic of discussion at meetings of the Association of Data Processing Services Organizations (Adapso), with the attitude evolving from apprehension to "if you can't beat 'em join 'em." And several services firms have become dealers for such manufacturers as Basic Four Corp. and Microdata Corp. In fact, service bureaus account for over half the U.S. dealers of each manufacturer. But none of the recent moves should be confused with this type of operation.

Xerox beefs up terminal

Xerox Computer Services is providing an intelligent terminal system to provide some local storage and preprocessing to users of its network. The 1350 consists of a keyboard display station, a 120 char./sec matrix printer, microprocessor control unit and four floppies and costs $745/mo or $15,000. This represents a substantial upgrade in price and capabilities from the 1340 daisy wheel unit that rents for $195/mo. In fact, the unit, made by Diablo, sounds similar to the 3200 small business system, which initially started life with floppies and then later acquired a hard disk.

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Keydata provides turnkey system

Keydata Corp. is continuing its affair with small distributors begun a couple of years ago with the 800 service. This time the company is offering a bundled, turnkey system called the Unity series designed initially for small distributors in the electrical, plumbing, heating and industrial supply industries. Later this year Keydata plans to add software for distributors of food, printing and paper. Manufacturing applications are scheduled to be added in 1979. The single-site, stand-alone system does not communicate with the Keydata network, although remote diagnostics are a part of the service. Keydata plans to develop a distributed processing system for distributors with multiple locations.

Whereas the 800 service is intended for firms using between $800-$1,400/mo of services, the Unity series is designed for businesses whose service requirements are in the range of $1,300-$6,500/mo, Keydata said. Systems prices, including a host of applications software and a year of systems support, range from $48,000 to $290,000. Hardware maintenance, priced separately, will be offered separately, will be offered separately through Keydata's agreement with Control Data Corp.

MODEL	KEYDATA PRICE	COMPETITIVE PRICE	ESTIMATED SOFTWARE PRICE	PRICE ADVANTAGE
IBM 32	$ 48,000	$ 59,876	$13-15,000	25%
IBM 34	$ 82,000	$ 98,060	$ 25,000	20%
Microdata Royale	$ 80,400	$ 98,585	$ 25,000	23%
Basic Four/ 700	$153,400	$169,200	$ 25,000	10%

Keydata's estimates of competitive systems prices compared with its Unity Series.

With minicomputer price/performance increasing at 30%/year, Keydata acknowledged the concept of in-house computing is becoming more attractive. The Unity series is "not a defensive move" but a means of broadening the market base.

Even if some customers decide to switch, it will not be to the firm's disadvantage, officials said. Eventually, Keydata anticipates picking up some of the remote business of Unity series customers as their companies expand. Keydata President L. Edwin Donegan Jr. indicated no policy has been made regarding charges, if any, for current users who opt for their own Unity system. The basic price includes conversion assistance for first-time users.

Emphasizing its support for the small user, Keydata's purchase price includes one year of systems support. The operating system, wrapped around Data General CPUs, allows Keydata to tailor reports to the user's needs.

ADP puts 2020s "onsite"

ADP's Onsite, which consists of a Decsystem 2020 with ADP's version of the Tops-10 operating system, is a "part of the service offering" and is not available on a lease or purchase basis. Onsite includes proprietary microcode and software

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developed by ADP during the past 10 years on its central Decsystem 10s. ADP Network Services application software is available for a price above that of the basic service. To EDP/IR the ADP offering looks like a true distributed processing system that can communicate with central site ADP processors, line printers at district offices, as well as with other Onsite systems via ADP's packet switch capabilities. More important, it can update and tap central data bases as necessary.

With an in-house computer, a user can control usage through some administrative packages and improve cost effectiveness, according to ADP. The Onsite gives four to 18 times the service per dollar; the typical industry average ranges from $18-$59/hr/user whereas Onsite costs $3/hr/user, the firm stated. Charges for the Onsite system, which ranges in size up to 2.5M bytes, begin under $10,000/ mo.

Indicative of the service concept is the 24/hr remote monitoring service and system diagnosis available from the central site, including error logging, automatic software distribution and remote analysis of software. Remote reconfiguration techniques will allow Onsite service to be restored after hard failures. ADP is marketing the service to large users of commercial time-sharing, as well as those with in-house DP departments.

NCSS to sell mini with its 370 software

National CSS has taken a slightly different approach in that it offers its system for sale, but the general theme is the same: putting its proven systems software at the user's site on a CPU that can be hooked into its network.

Based on Two Pi Company's first product, a 32-bit mini that emulates the 370, NCSS' 3200 is equipped with its operating system, VPS. Nomad and other sophisticated software goodies are available. The 3200, said to emulate a 370/138, costs between $235,000 for a 512K system to over $400,000 for 2M bytes. VPS provides up to 8M bytes for user programming; an equal amount is reserved for NCSS facilities such as the VPS/editor, executive and file system processors.

The system reportedly operates 50% to 60% faster than superminis such as DEC's VAX 11/780, Data General's M/600 and its expected 32-bit big brother; Interdata's 8/32 and Prime's 500 as well as the Decsystem 2020. The power of the 3200 is reportedly about the same as a 138 and slightly faster, at about half the price. A 512K 3200 CPU costs $160,000 vs. $292,180 for the same size 138.

Although the machine could serve as a 138 replacement, those users are not NCSS' prime target; rather, NCSS will let those users come to it. NCSS is seeking the business DP segment of the megamini market -- machines in the $150,000 to $500,000 range. This market, estimated at $248 million this year, should grow to $718 million by 1982, a compound growth rate of 38%. When other segments are added, NCSS' target market expands to $301 million in 1978 -- and a projected $814 million by 1982 when megaminis will represent 50% of all mini revenues, according to IDC estimates. The target customer is a manager of a plant or division with an eight figure budget who depends on and is unhappy with his inhouse system.

The NCSS 3200 would seem to be an obvious answer for 370-based users seeking to venture into distributed data processing; programmers need not change their ways of thinking when creating programs for the 3200. And, the NCSS software is proven. The system supports Fortran, Cobol, PL/1, Basic, APL and BAL and is compatible at the instruction set level with the 370. NCSS estimates 80 of its network customers will find the 3200 a more cost-effective solution; but it also

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expects to gain customers from remote services firms. In addition, 3200 users can call on the NCSS network for overload, backup or extension of 3200 applications requiring other capabilities. Furthermore, NCSS has software that can manage internal networks of 3200s. Three varieties of software are available: 2780 Hasp-type for a $2,000 one-time fee; packet switching for $10,000; and software for delivering files, $2,500 plus a usage charge of $1 per 1,000 lines.

Two Pi enters supermini market

Two Pi Co., Inc. used bit slice architecture and 32 microprocessors to create the V32, a 32 bit mini that it says operates in the same performance class as the 370/138 and is compatible with the 370 instruction set. The unit can handle up to 4M bytes and operates in virtual mode.

Extensive microprogramming facilitates modification of the system, which is available only on an OEM basis without any operating system. However, it accepts the IBM version. The basic system includes 256K, a byte multiplexer channel and a refrigerated air cooling system. Target customers, in addition to services companies such as NCSS, include plug-compatible peripherals vendors.

The system architecture utilizes Advanced Micro Devices (AMD) 2901 design 4 bit chips, each of which contains all elements but partial amounts of the arithmetic logic unit. Memory consists of 16K RAMs with 200 nsec access time.

If the V32 can act like a 138, could it act like a 148? A spokesman indicated the firm has no plans to make it resemble a 148. Currently the Two Pi/V32 accepts IBM-type peripherals; however, the company plans to devise controllers to permit use of mini peripherals, thus giving the system about a 2:1 price advantage over IBM, according to the company.

Two Pi, founded three years ago by Dr. Jared Anderson, Lauren Yazolino, Van Van Gelder and Jim Braun, was bought lock, stock and barrel a year an a half later by U.S. Philips Corp. Two Pi expects to be shipping production machines by mid year and said it has a multi million dollar backlog. There is no connection between Two Pi and Philips Data Systems in Europe, and no license agreement for the latter to manufacture the V32, a spokesman said.

Although Two Pi does not quote prices, it is clear from those cited by NCSS that this machine -- and possibly others like it -- will shake up the plug compatible mainframe scene's pricing strategy.

Plug compatible scene getting hot

If Two Pi can put chips together, why not a chip maker? National Semiconductor, which already makes CPUs for Itel, is planning to introduce "its most significant computer system yet" that will mark a major new direction for the company. There's no question about it, the U.S. installed base of systems in the size class of the 138 is large in terms of number of units -- 11,461 systems at year end 1977, according to IDC figures. There are a host of current and potential suppliers in the area of 148 and below. CDC markets Cambridge Memories' product, the Omega, Itel markets National Semi's products, called the AS/4 and AS/5. Both Cambridge and National are suspected of contemplating entering the market themselves, as is Magnuson Systems, With minis acting more like mainframes, thanks to micros, more entrants are likely. Vendor survival will depend on finding a niche and offering support; linking with a services firm is a clever way to do just that.

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• MINI MAKERS REDUCE MEMORY PRICES. Hewlett-Packard Co.'s new price on main memory for its 1000 Series is 3.1 cent/byte compared with a previous 5 cent/byte; 128K of 16K-bit MOS costs $4,000 compared with $6,400. The price changes translate into a 35% price cut on the larger 1000 models; a 512K byte M series computer now costs $21,750 compared with $33,450. The move follows one made on the 3000 Series (EDP/IR,March15). At DEC, 128K of MOS for its PDP 11/04 and 11/34 now costs $6,400, a 37% discount compared with the previous price. Core discounts range from 9% to 26%; 128K core for these machines costs $10,400.

• MEMORY MAKERS SET SIGHTS on other mainframers' product lines. Cambridge Memories unveiled memories for 14 CPUs in the HIS Series 200 and 2000 lines while Computer Enhancement Corp., Costa Mesa, Calif., announced RAM for NCR Criterions in the form of a board that accepts both 4K and 16K chips, depending on the model of the Criterion. Meanwhile, back on the IBM front, Cambridge is offering add-ons for the 303X series, using the same basic memory system as on its 158, 168 versions. Cambridge indicated IBM appears to be limited in its production of memory as the early deliveries are of machines with small memories. Reaping in the harvest on the 370 line, Electronic Memories & Magnetics Corp. said its backlog for 148 memory is the highest in the firm's history for an IBM add-on. Backlog amounted to over 20M bytes of 148 memory on order and/or installed. For the oldie but goodie, Ampex is shipping a unit that handles up to 9M bytes on a 360/65. An Ampex 2065 storage discriminator creates up to four independent memory ports.

• AT&T IS STILL FIGHTING SUPPLYING LOCAL LOOPS TO specialized common carriers such as Southern Pacific Communications (SPC) and MCI -- other parties to the hoopla are the FCC and the courts. The latest word is that the appellate court will meet en banc April 28 to rehear AT&T's argument on why it should not have to obey a ruling by the court of appeals on April 14 that it should provide the local loops. The FCC had previously told AT&T it didn't have to make additional connections (EDP/IR, March 15). The April 28 hearing was granted in response to separate motions filed by AT&T and the FCC to stay the court's order. AT&T intends to go to the Supreme Court if necessary to get its way. Ma Bell also has made mutterings about filing for a tariff that would structure the rates for local loop offerings in the same way as for Message Toll Service. That would mean a hefty increase in rates payable by MCI and SPC, which need the local loops to connect customers to their services.

• AFTER NEARLY THREE YEARS, BOTH IBM AND JUSTICE seem intent on getting through with the trial. Justice decided not to request interim relief because that move could substantially delay the trial. And IBM has passed up the chance to file a motion to dismiss the case. Why? One possible reason is that it wants the chance to exonerate itself now, rather than later, as would be the situation if its motion were granted and it had to keep its legal team ready to jump into action after a lengthy appeals process. IBM's record of success in obtaining dismissals or directed verdicts has been good, but both the Calcomp case and the Greyhound action have yet to be put to bed. An appeals court ordered Greyhound back to court, and the Calcomp appeal will be heard shortly. Even while Justice was finishing up its case, IBM started entering masses of documents in a very expeditious manner.

• UNIVAC GETS A NEW PRESIDENT, and an old friend in a higher post. Gerald G. Probst has been promoted to group executive vice-president for computers, business equipment, defense and aerospace operations of Sperry Rand. Richard L. Gehring, whose background is in both commercial DP and defense, was named Univac president.

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• DATA ABOUT COMPUTER OPERATIONS OF MAINFRAME COMPANIES keeps getting better as the firms comply with the Financial Accounting Standards Board's requirements for more disclosure ... or simply regroup the operations they assign to data processing. As an example of the latter, Burroughs in its 1977 annual report gave a history of its data processing operations that was just about $100 million a year above what it had been showing, bringing 1977's revenues to $1,794 million for its computer-related operations.

Univac's computer revenues, including those from its minicomputer operations, jumped from $1,470 million in fiscal 1977 to $1,725 million in fiscal 1978, reflecting a surge in the fourth quarter. The fiscal 1978 figure, which includes about $35 million from minis, is preliminary but should be very accurate.

And IBM, in its 10-K annual report filed with the SEC for 1977, admitted it "is the largest manufacturer of data processing machines and systems in the information-handling field, which is comprised of many companies and is highly competitive." And for the first time it gave a breakdown -- to whole number percentages only -- on its data processing income:

	1973	1974	1975	1976	1977
Equipment	74%	73%	72%	72%	70%
Sales	17	20	18	23	25
Rental/Service	57	53	54	49	45
Services, program products, supplies	10%	10%	10%	10%	11%
Sales	3	3	3	3	3
Rental/Service	7	7	7	7	8
TOTAL Data Processing	84%	83%	82%	82%	81%
TOTAL GROSS INCOME ($M)	10,993	12,675	14,436	16,304	18,133
Sales	3,372	4,282	4,545	5,959	7,090
Rental/Service	7,621	8,394	9,891	10,345	11,043

The figures indicate general trends for IBM's operations and, as such, are highly interesting. Readers are cautioned from casually applying the percentages against the gross income figures. In 1977, for example, the total data processing figure could vary from $14,600 million to $14,775 million, depending on the fraction of a percent. For that year, however, IBM stated the actual number: $14,765M.

• LOWER PRICED V5 AND V6 are the result of Amdahl's latest moves. Amdahl reduced the minimum number of channels and the price of memory on its V5 and V6 in order to bring their price/performance ratios more into line with that of the forthcoming V7. Memory prices, formerly $220,000/2M bytes, are now $170,000/2M. Memory, formerly available in 1M increments, is available now only in 2M increments. The V5 and V6 now have a minimum of eight channels rather than the previous 12 and 16, respectively. The prices of minimum 4M systems are now $2.15 million for a V5 compared with $2.4 million and for a V6, $2.58 million rather than the previous $2.98 million. A group of four channels costs $150,000. Evidently some users prefer to pay less and have fewer channels.

The firm is currently busy tweaking its software version of the IBM hardware portion that runs MVS/SE. Amdahl has MVS/SE up and running and will offer its software feature "later this year" but has not decided whether to charge separately for the item.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MAY 5, 1978 • VOL.13,NO.20 P.J.McGOVERN,PUBLISHER

U.S. rests its case vs. IBM - Page 2

CAI's VIRTUAL NETWORK PLAYS IT SAFE HANDLES BOTH SNA AND X.25 PROTOCOLS

Based on the premise that users want to play it safe and back both horses, Computer Automation, Inc.'s Virtual Network (VN) is a "completely soft" scheme that permits transmission via both protocols. Thus, while the war between AT&T and IBM is raging, users of VN can relax, according to CAI.

The CAI announcement is the latest in a series of vendor schemes to make distributed data bases transparent to the users. Significant characteristics of the CAI plan are its ability to accommodate various brands of terminals and CPUs as well as possible protocol changes.

CAI anticipates the VN customer base will be firms with three or more mainframes, at least one of which is overseas. The VN should pay for itself within about a year through cost savings from better use of communications lines and equipment, the company said. Some of the features and elements:

- Concurrent support of SNA/SDLC, X.25 and bisynchronous protocols permits use of terminals such as 3270s, 3790s, Dataspeed 40/4s. The net may be interfaced to packet-switching networks.

- Syfa systems provide two synchronous communications channels; intranet communications are handled at the file message level in X.25 at 56K bit/sec; an additional channel can be used to concurrently communicate in interactive or batch mode with a mainframe or other distributed installations.

- The second synchronous line can be used to multidrop Syfas to an IBM mainframe using 3270 or 3790 (SNA/SDLC) protocol. Syfas can also communicate with the host in a point-to-point batch mode using IBM 2780, 3780 or 360/20 Hasp workstation protocols.

- CAI's VN controller, based on an LSI 4/90, is "the traffic cop" for intranet communications.

- Network processors are Syfa systems with a microbased Distributed Data Base Processor that links via X.25 and can be down-line loaded.

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• Expansion can be to an "unlimited number" of processors, terminals and disk units via interlinking VNs.

A VN controller can accommodate up to 31 Syfa processors, which may be linked via a mixture of hard-wired lines and remote telecommunications, and up to 992 Syfa terminals and up to 74.4 billion bytes of disk. The price of a VN controller that handles 15 processors is $31,500; the larger version costs $47,500. Distributed data base processors, needed in every Syfa processor, cost $7,500 and an optional backup net controller is $20,000. The basic price for a single Syfa ranges from $29,000 to over $150,000. First deliveries are scheduled for third quarter, 1978. There is a one-time charge, ranging from $1,500 to $7,500, for communications emulators. The rest of the software is bundled.

CAI gave a clue as to future plans when it said it expects to offer other communications processors, based on the same micro unit, that can be down-line loaded from a central site in order to accommodate changes or enhancements.

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Three years in Foley Square!

AS IBM STARTS ITS DEFENSE, THE BIG ANTITRUST CASE WILL FOCUS ON INTENT

The design of the 360/91, announced without complete product tests in 1964 to lure the Bettis and Knowles Atomic Laboratory away from CDC, was likened by an IBM executive to "shooting an arrow into a wall and painting a bullseye around it."

Nearly three years -- and 473 days in court -- after opening arguments, the government rested its case against IBM on April 26. During those three years, attorneys placed 3,200 exhibits into evidence and examined 52 witnesses; the transcript is 75,000 pages. The length of the case, the longest trial in U.S. history, prompted IBM Chairman Frank T. Cary to label it the "Methuselah of antitrust cases." Indeed, the length of the case apparently has numbed the world to the events in Judge David N. Edelstein's court, room 110 in Foley Square. But inveterate denizen of that room and Computerworld reporter Catherine Arnst indicates the outcome could set a precedent for future antitrust suits. EDP/IR presents her assessment of the government's case.

Because IBM is charged with monopolization through market practices that are not illegal in and of themselves, the government must prove that these practices were undertaken to gain monopoly power. This is a difficult task as IBM can counter such charges with the defense that it only indulged in standard competitive market practices. At issue, then, is not so much whether IBM took such actions; the issue is why. IBM's main defense is that its success is due to skill, foresight and industry -- it was an innovative company that was willing to take risks and succeeded because of those risks.

The task before the government in this case is more complex than in its suits against United Shoe (1953) and Grinnell (1966); in these instances monopolization occurred as a result of mergers and acquisitions, which created a rather clearcut case of intent. The government charges IBM with violating Section 2 of the Sherman antitrust act, which is simply worded to make unlawful "every person who shall monopolize or attempt to monopolize ... any part of the trade or commerce." But prior case law has given that language a far more complex meaning. The offense of monopolization requires not only possession of monopoly power in the relevant

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market but proof of intent to acquire or maintain that power. The government's case can be broken down into three main elements:

- Proof that a relevant market exists.
- Demostration of IBM's monopoly power in that market.
- Proof that IBM's conduct in that market was anticompetitive in intent and effect.

Market definition -- at the heart

Market definition is at the heart of the case and the government dedicated a major portion of its case to that subject. One of the criteria of a relevant market is the lack of items that can serve as substitutes. The availability of substitutes renders the market amorphous, ill-defined and no longer "relevant."

Every major action the government has won under Section 2 involved a sharply defined market; one of the reasons it lost its case against duPont in 1956 was because of the court's finding that, although duPont had 75% of the cellophane market, it had only 20% of the "flexible wrapping material" market.

IBM has been charged with monopolizing the "general-purpose electronic digital computer systems" market. In the government's Statement of Triable Issues, these systems are defined as "electronic digital computer systems generally included in a manufacturer's commercial product line and comprise the hardware, software, maintenance and services necessary to perform a broad range of commercial applications as the primary function of the system."

The government later amended its complaint to include the charge of monopoly in the peripherals "submarket" -- including plug-compatible disk and tape drives and their associated controllers and add-on memory. The government charged IBM wielded its monopoly power over these markets by:

- Frequently changing its interface so as to obsolete competitive plug-compatible products.
- Discounting prices on its own equipment (with a corresponding rise in the price of another part of the system).
- Refusing to maintain IBM systems with foreign equipment attached.
- Offering long-term leases that locked in users to IBM equipment.

Many of these charges have been heard in other trials, such as Telex, Memorex and CalComp. The peripherals area was one of the more glamorous parts of the govnment's case; a long string of witnesses testified against IBM. Most of these witnesses were affiliated with companies that had struggled to make it in the peripherals market from their inception, and the image was conveyed repeatedly of the little company trying to survive against the giant. On the other hand, there were a lot of those little guys, which is why IBM has asserted that the peripherals market was an extremely competitive one which was easy to enter.

General-purpose computer systems are considered by the government to constitute a distinct and separate market which excludes large-scale special purpose or

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scientific systems and small scale, mini and micro computers. Emphasis has been placed on the "systems" nature of the market, as opposed to separate markets for each component in a system. IBM has contended in this case that it does not sell systems, it sells boxes.

However, each industry witness testified that his company recognized that it would have to offer a total systems package in order to compete with IBM, and users generally buy a system rather than one box unless they are upgrading their current system.

IBM has faced competition from nine manufacturers in the general-purpose systems market between 1960 and the present, the government claims. These are Univac, Honeywell, Burroughs, Control Data Corp. (CDC), NCR, Xerox, General Electric (GE), Singer and RCA. There was considerable testimony concerning the exits of GE, Singer, Xerox and RCA from the market after suffering substantial losses. One measure of monopoly is the existence of barriers to entering a market.

Proof of substantial barriers to entry, according to government economists, lies in the inability of these companies to successfully enter the market although they all enjoyed large profits in other unrelated markets which could subsidize losses they suffered in the DP arena. Also, executives from these firms testified that they fully expected to suffer some losses for a number of years in the industry before showing a profit, and they did not expect to ever come near IBM's position in the market.

The losses they actually incurred, however, far exceeded their expectations. In a chart developed by Dr. Alan McAdams, the government's chief economic advisor for this case, cumulative losses on existing the market ranged from $340 million for Singer to $975 million for Xerox.

Market share -- and profits

McAdams, who testified for 78 days on behalf of the government, developed a large number of charts designed to show IBM's share of the U.S. general-purpose market. Whether based on statistics from IBM internal reports on competitors, figures obtained directly from manufacturers by government subpoenas, or International Data Corp., IBM's share of the domestic installed base of general-purpose computer systems always hovered around the 70% line in these charts. Each of the other firms' shares was generally below 10%.

The most startling chart McAdams developed demonstrated that IBM's profits were so great from 1960-1972 that the firm was solely responsible for the industry showing overall profitability. In 1972, for example, the combined earnings of all the firms on the chart equaled a loss of $449.9 million. When IBM's profits for that year were added, the industry aggregate jumped to a plus of $923.4 million, according to McAdams.

The issue of intent

Once the government presented its evidence that there was a relevant market and that IBM had the lion's share, it had to tackle the problem of intent. This part of the plaintiff's case was broken down into several portions, each related to conduct allegedly taken for anticompetitive reasons. The government charged IBM with attempting to monopolize the general-purpose market through five major market practices:

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- Bundling the price of software and maintenance with the price of the hardware.

- Introducing "fighting machines" which either had low profit expectations or were announced prematurely in order to impact competition -- the 360 announcement, the 360/44, 67, and 90 series.

- Educational allowances to prestigious universities and colleges which acquired IBM equipment.

- Creating and controlling the leasing environment in which the computer industry primarily operates.

- Setting de facto standards for the industry.

Bundling: bright light in dark courtroom

Bundling was one of the brightest portions of the government's case, possibly because it had at its disposal a plethora of internal IBM documents which acknowledged that tying in software and services with the price of the system gave the firm a competitive edge.

IBM learned that lesson from the unit-record equipment market, where it applied the same practices. When it entered the computer market, it included in its bundled price the computer hardware, software, customer education and training, maintenance service, systems engineering services and any other support services necessary. As a result, any manufacturer trying to compete with IBM had to offer a complete line of services, which in turn created substantial barriers to entry, the government charged.

IBM defended its "service-oriented approach" as offering the greatest benefit to the customer. However, as the sixties wore on the firm became increasingly aware of the legal issues surrounding the practice, according to the documents.

A centerpiece of the government's presentation of this subject was a 29-page report by J.P. Maurer, manager of corporate pricing at IBM's headquarters, written in 1965. The study considered the desirability of establishing separate prices for services. It was prompted by congressional hearings on how the government would handle its DP procurements as well as by growing realization that all users didn't require extra services or could obtain them from an outside vendor, according to Maurer.

IBM announced its decision to separately price certain portions of its bundle on June 23, 1969, five months after the government filed its suit. According to a document written by Hilary Faw, IBM's assistant treasurer, dated Dec. 18, 1968, IBM's legal counsel had already determined that those services represented an "illegal and indefensible tie-in sale under the antitrust laws," and he wrote that IBM's top executives had reached the same conclusion in September, 1968.

This memo alone gives credence to the government's charge that IBM was aware of the market power gained from bundled pricing and "retained the bundled price environment for as long as possible. Its intent in doing so ... was to exclude competition and retain the ability to so control prices." Apparently IBM decided to continue its bundling policy as long as it thought feasible -- nearly a year after executives had become aware it represented tie-in sales.

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'SKILL, FORESIGNT AND INDUSTRY' OR CONTAINMENT?

The government's case was capsulized in the testimony of Dr. Alan McAdams, the Department of Justice's Chief Economic Advisor for the trial. His testimony covered all bases -- market share, IBM's power in the market, conduct and the economic theory on which the government's case is based.

McAdams, a professor of economics at Cornell who has been working on the case in some capacity since 1971, showed considerable bias in his analysis of the case. However, that analysis was strengthened because it concurred with the conclusions offered by Frederick Withington, an Arthur D. Little consultant, who testified about the real world events that supported McAdams' theories.

The most extensive portion of McAdams' testimony concerned market definition and measures of IBM's power in that market. He concluded that IBM maintained its monopoly power by both active and passive barriers to entry -- passive barriers being those that already exist in a market when a competitor tries to enter and are not directed at any one firm, and active being those directed against a specific firm or market segment.

A key phrase in this trial is "Skill, Foresight and Industry" -- a shorthand economic description of the actions a firm takes that are motivated so solely by a desire to benefit the customer. Although IBM may have a reputation for exhibiting those qualities, the company actually introduced most of its price cuts out of a desire to contain competition, McAdams testified. IBM is sure to spend considerable effort trying to prove otherwise, since those words are the bottom line of any attempt by the government to prove in intent.

The most impressive support the government offered for its delineation of the market came from Withington, who testified that scientific computers, although they could be adapted for general-purpose business applications, are in practice virtually restricted from that market.

Fighting machines fought by documents

The fighting machines portion of the government's case was contained primarily in the documents it placed in the record; only one witness testified in this area. In its opening statement, the government defined fighting machines as "selected computer products announced and introduced by IBM in markets in which competing computer firms threatened to achieve unusual success thereby threatening IBM's overall monopoly."

These machines were supposedly characterized by accelerated announcements to customers before they were put through the traditional IBM testing and review procedures -- when IBM management knew substantial technical risks were still present, the Justice Department said. It aimed these charges at IBM's System 360 announcement in 1964 and at some individual models of the 360 --the Model 90 series, the 44 and 67. One fault with these charges is that those three models are not included in the government's definition of the general-purpose computer system market, as they are large-scale scientific systems.

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Educational allowances

The last three segments of the government's conduct case were presented in much greater brevity than either the bundling or fighting machines portions. Educational allowances related to IBM's practice of discounting equipment and services provided to prestigious educational institutions, as well as grants and personnel support. IBM was not the only firm providing educational allowances.

Leasing -- a barrier to entry?

Leasing provided the government with a stronger case, as several financial analysts and corporate executives testified that the computer industry was especially difficult to enter because of the leasing environment.

For a company to survive in a leasing environment, it had to have enough capital to underwrite the costs of starting up, manufacturing and marketing over several years as there would be no immediate revenues gained from the sale of equipment. The government has charged IBM with manipulating and maintaining that leasing environment to its own advantage through the use of long-term leases with stiff cancellation charges and lease/purchase rations which discouraged the growth of third-party leasing companies. The leasing environment was advantageous for IBM because it allowed the company to maintain "complete control of its property," McAdams testified.

Standards: IBM won some, lost some

The standards issue is not so clear cut. According to the government's pretrial brief, IBM exhibited the power to establish de facto product standards for the computer industry, and that power exists because of its monopoly share of the general-purpose systems market. The defense to this charge is obvious; if IBM equipment is generally accepted in the market because it is a superior product, then as a matter of course it will become a standard in the market. Another weakness of this charge, is that, although several of IBM's product standards did become industry standards, several others did not -- the American National Standards Institute selected Ascii instead of Ebcdic.

Outcome could influence law

If the government ultimately prevails (an outcome which will not be known for several more years, since any decision in this court will go through a long appeals process), it will set a new precedent in antitrust law, and have a pervasive influence on economic policy in this country. IBM will not lose because it committed any acts blatantly illegal in and of themselves but because it became a huge and powerful company that wanted to stay huge and powerful.

There's more at stake here than merely the future direction of the computer industry. If the government should win its case, antitrust watchers say it will mean that large companies are forced to operate under different guidelines than run-of-the-mill competitors in a marketplace. The precursor of this logic shows up in the Ninth Circuit's decision ordering Greyhound vs. IBM back to trial (see EDP/IR, Aug. 29, 1977). There, the court stated that if the jury found IBM possessed monopoly power in the computer leasing submarket, "IBM would be precluded from employing otherwise lawful practices that unnecessarily excluded competition from the market."

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• TIME WAS WHEN TELEPHONES AND COMPUTERS WEREN'T related, but those days seem long gone. Even companies whose traditional product lines are telephone accessories are now making terminals, and at least two vendors supply products to convert a rotary dial telephone to a Touch Tone phone -- shades of the phone phreaks of the 60s. While the Congress ponders rewriting the Communications Act of 1934 and the Second Computer Inquiry searches for a dividing line between communications and computers, both of which could affect AT&T's future stance, smaller firms are busy flying toward the flame ignited by the coalescence of DP and communications. Plantronics added alphanumeric data entry capability to its VuSet terminal for which it has received a 3,000 unit order from Western Electric ... Transcom, Inc., a unit of Hi-G, Inc., Windsor Locks, Conn., is marketing to salesmen its Audioport battery-operated Touch-Tone pads that acoustically couple to the mouthpiece of telephone headsets.

Buscom Systems, Inc., Sunnyvale, has a Soft-Touch device that replaces the phone's mouthpiece by screwing into the phone company's handset. In addition to permitting data entry via the numeric pad, the device also functions as the mouthpiece. Buscom has filed for FCC registration on the unit incorporated into a telephone.

And Rolm Corp., maker of PBXs, has a multiple key phone with an embedded micro and eight digit display that can accept and store messages sent by other similar phones that are part of Rolm's computerized business telephone system.

• KEEP AN EYE ON PRICING OF COMMUNICATIONS services -- and various methods of transmission. Telenet is asking the FCC for permission to offer uniform nationwide pricing for users accessing its net over dedicated or leased lines. Rates would be determined by transmission rate. Telenet also wants Private Packet Exchange, a plan enabling customers to buy a group of ports at specific Telenet locations...

The FCC okayed Western Union's plan to categorize transmission speeds above 150 bit/sec as sub-voice grade services.

• THERE'S MORE THAN ONE WAY TO SEND DATA. Schemes to avoid dependence on the telephone industry are proliferating as data seems to fit nearly anywhere. Once there was data under voice with Ma Bell; now FM signals are in the news. Digital Broadcasting Corp., Vienna, Va., plans a transmission service via commercial FM broadcast subcarriers. The scheme appears to circumvent dependence on local lines. After transmittal via Telenet to the Digital Broadcasting (DB) data center in McLean, Va., the message is routed via 4,800 bit/sec leased lines to the appropriate FM station where it is sent to the final destination via a 67.1 MHz cocarrier on the FM band or, in those locations where FM is not feasible, such as Manhattan, via phone lines, a DB spokesman explained. Over 50 FM stations are in the process of obtaining FCC permits to utilize a subcarrier frequency. The service is expected to be available in D.C. by the end of May. DB picked up $5 million cash and $25 million long term financing from the sale of 50% equity to Consolidated Industries of America Corp.

Motorola has a portable terminal with a nearby FM transmitter and receiver that reportedly can send signals to a 370. However, to get to the 370, the signal on the UHF business band must be received by a nearby FM base station, which transfers it to an RDX 1100 control unit that communicates with the CPU via conventional methods. The hand-held terminal costs $3,600, the base station $4,500 and the control unit $19,800. Distance between terminal and base station can be a couple of miles.

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REVIEW & FORECAST

EDP industry report
• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MAY 19, 1978 • VOL.13,NO.~~20&21~~ 21+22 P.J.McGOVERN, PUB.

A very elastic market

COMPUTER SHIPMENTS JUMP 20%; SIMILAR GROWTH EXPECTED THIS YEAR

No matter how you measure it, 1977 turned out to be a very good computeryear indeed. And 1978 is stacking up to be equally good . . . perhaps better.

As anticipated (EDP/IR Apr.22,1977), total shipments of computers by U.S.-based manufacturers were up 20% in 1977 to $15.7 billion -- and an increase to the $18.7-billion level for this year is forecast by IDC. Revenues to services companies totaled almost $6 billion; the installed base of data entry/communications equipment reached $11.5 billion; minicomputer shipments, part of the total, zoomed almost 45% to over $2.3 billion; and the small business computer market came into its own as shipments increased 40% to the $1.2-billion level.

But the year 1977 -- filled with product announcements ranging in size from IBM's 3033 to microprocessors -- will probably be best remembered for its verification of the elasticity of the marketplace and the coming of age of the so-called plug-compatible mainframe sector. Here are specific highlights of 1977:

- IBM introduced the 303X processors and cut System/370 prices; others beefed up large system offerings and boosted price/performance of midrange systems. Large systems efforts ranged from a paper tiger -- HIS' 66/85 -- to new technology in Burroughs' latest 6800s.

- Superminis were given more software by their manufacturers as well as some from independents while micro-based systems increasingly began to erode some markets long the bastion of plain-vanilla minis. Again, software remained the key element in the marketing fight.

- Distributed processing, still a buzzword, neared reality as several vendors brought out their own internal communications schemes.

- Software in general emerged as the key to performance for hardware. And, more and more vendors are electing to improve their systems' performance through microcode.

- The debate over regulation vs. deregulation -- plus confusion about what separates data processing from communications and vice versa -- continues among the major marketplace forces.

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- Litigation did not take any holiday. IBM began its defense in the U.S. antitrust trial (EDP/IR May 6,1978) and is learning the hard way that directed verticts can come back to haunt, as in the Greyhound case. The Calcomp case, in which IBM also received a directed verdict, is in the appeals process; the Memorex case is nearing completion of its first round.

What's more, the year just past marks a distinct shift in the computer users' environment. After several years of business-oriented, budget-conscious management -- that resulted in relatively flat computer shipments -- data processing departments again are centers for action. Several forces are expanding budgets:

- Money can again be spent to increase the level of service rather than strictly allocated to cost-justified projects;

- Distributed processing, often the most economical way to provide service -- taps budgets throughout an organization;

- Availability of the new price-performance mainframes is stimulating new applications development rather than reducing hardware budgets.

All in all, a period of accelerated spending for hardware and services seems to lie ahead. This spells good times for the computer industry, and the IDC forecasts in this issue reflect this outlook.

WORLDWIDE GENERAL-PURPOSE COMPUTER MARKET FOR U.S.-BASED MANUFACTURERS
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	1977 Shipments		In Use Yearend 1977:		
	$M	% Total	$B	% Total	1976-77 Change
IBM	$8,275	67.5%			
PC Periph.	525	4.3			
Amdahl	190	1.6			
Itel	75	.6			
IBM Systems	$9,065	74.0%	$55.0	71.7%	+ 14.0%
Burroughs	835	6.8	4.4	5.8	+ 16.0
HIS + Xerox	765+	6.3	6.3*	8.2	+ 7.3
Sperry Univac	750	6.1	5.8	7.5	+ 8.2
Control Data	345	2.8	2.6	3.4	+ 9.5
NCR	335	2.7	1.8	2.3	+ 13.8
DEC	135=	1.1	.6	.7	+ 26.8
Singer	0	0	.3	.4	- 1.2
Cray	20	.2	-	-	-
SUBTOTAL	$3,185	26.0%	$21.8	28.3%	+ 10.4
TOTAL	$12,250	100.0%	$76.8	100.0%	+ 12.9%

*Includes equipment manufactured by Xerox
+Does not include $130 million in minicomputer revenues
=Does not include $1,100 million in minicomputer revenues

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Mainframes -- more for less

As mentioned above, mainframe (and peripheral) manufacturers tested the elasticity of the marketplace . . . and found it there. Lower prices and higher performance ratings can mean greater revenues through increased volumes. Prior to 1977 there were industry observers who suggested such price/performance improvements would decrease shipment volumes (or at least slow increases); today, proponents of such theories are back at their drawing boards. More bang for the buck still means more bucks.

As a result, IDC's forecast of average value of general-purpose shipments -- a convenient ratio to look at in examining longer-term developments --will continue to climb through 1982. In the face of higher performances, users are adding more "goodies" to systems -- more memory, disks, and/or communications capabilities -- and thus raising the final pricetag.

In providing more price/performance, mainframers both adjusted prices and introduced improved products. One favored area (though not chosen by IBM) was to utilize higher density semiconductor memories -- up to 16K-bit chips in the case of Burroughs and Univac. On the price side, IBM collapsed its umbrella, but other mainframers said their margins would not be adversely affected . . . and all turned in strong financial performances for the year. Here's a rundown:

Burroughs, as usual, did its technology homework; it put charge-coupled devices (CCDs) in the file memory of its scientific processor, a specialized CPU that performs parallel processing. And, again illustrating probable future computer architecture, it brought out the Attached Fortran Processor. Burroughs new top-of-the-line 7800 consists of four dedicated processing units per system, and up to eight processor systems, either CPU or I/O, can be linked together. At the small end, the B800 is designed to be a more powerful replacement for the B700 series. One model, the B820, combines bipolar and MOS memory to expedite processing. Smaller and larger B80s were also introduced. Other equipment introduced during the last year includes Burroughs' Dexnet, which can link other facsimile units with its high-speed 5100 that receives and sends a page of text in 20 sec.

Control Data spent the year firming up its positions in services, which account for 20% of its computer-related revenues, in addition to minding the shop for its OEM equipment and mainframe line. Perhaps the most notable expansion (or new activity) has come from CDC's peripherals division, which is marketing the IBM plug compatible Omega system designed by IPL Systems Inc. For its own computer base, CDC framed its Cyber line, adding the entry level 171 and the top-of-the-line 176. During the year it also lowered the cost and configuration of a minimum 176 while adding three models to the Cyber 175 line. And, to keep its super-large system customers happy, CDC added a medium-scale preprocessor called the MP 32. In what is possibly a pace-setting move, the firm -- an early pioneer of separately pricing software in a significant manner -- began transaction pricing of selected application software.

On other fronts of this diversified computer industry firm, CDC established a special OEM division to develop and market terminals and peripherals for use on IBM's Series 1 minicomputer. For the education market it has been wooing, CDC announced a third price cut for the reactive Plato terminal, bringing its cost down to one half what it was originally. Also, during the year, CDC didn't let any cobwebs grow on its reputation for cooperative ventures with foreign firms and/or governments, and it continued to criticize the U.S. policy (or lack thereof) on the export of DP systems.

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Honeywell continued its emphasis on distributed processing, adding a raft of Level/6 minicomputers that operate with its Distributed Systems Environment, the Honeywell terminology for its latest approach to the large systems area. HIS also beefed up its small-scale Level 62, targeting the System/3 market that is apparently being overlooked by IBM. In the area of larger machines, it introduced and then replaced the Level 64 models 30, 50, and 60, made in France, with one modular version of the Level 64. And at the large end, HIS announced (then later killed) plans for a top-of-the-line 66/85. To fill in, the company dressed up the 66/60 and 66/80 -- calling them the 66 and 68 Distributed Processing System while chopping their prices to put them more in line with the current IBM prices. On other fronts, Honeywell expanded its interest in terminals, broadening its own product line and acquiring Incoterm, thus establishing a foothold into the world of banking and other industries with specific terminal needs. The company was among the first to unveil a high-speed non-impact printer, the Page Printing System.

NCR expanded its Criterion line with models 8560, 8580, and 8590 . . . and hinted that the line will grow to include an 8600. In the medium range, it announced the 8400, based on Criterion architecture, and the 8300, based on Century architecture. And at the small end, NCR unveiled its I-8100 series, including an 8130 and 8150, and added the 8250 to the line of multiprogramming 8200s. For its 499 electronic accounting machine users, NCR brought out a number of specific applications such as one for county road systems. NCR solidified its already firm position in the POS arena with an upgradeable 2140 that can start as a free-standing electronic cash register and, with the addition of a circuit board, become a POS terminal when necessary. And to firm up the very low end of the retail line, NCR added a 2115 electronic cash register.

Sperry Univac spent the year filling out its line of 1100 and 90 series computers (plans for an actual "bridge" line between the two families were dropped) and peddling the BC/7 small business computer to first-time users. New members of the 90 series range from the 90/25 to the 90/40 and the 90/80-2 and -3. The 1100/80, 83, and 84 were added, also. From a hardware standpoint, the 1100/83 and 84 as well as the 90/40 incorporate 16K-bit memory chips for main memory. In addition, Univac has made a stronger bid for IBM converts, offering a system that lets IBM programs run unmodified on the 90/80 while the user converts to the VS9 operating system. The low-end, turnkey BC/7 system grew to three models later in the year; the low end uses diskettes rather than the cartridge disk of the original model. Up until now, Univac has kept its Varian minis as a separate product line and reported that the operation contributed about $35 million in revenues for calendar 1977.

Enter: Compatible Mainframes

The concept of the IBM-compatible mainframe came of age last year. Proving they were a force to be reckoned with and not just a passing fancy, the plug-compatible mainframe manufacturers (PCMMs) shipped more of what IDC calls Size Class 7 (168 and above) computers than did all the other non-IBM mainframers. And for 1978, IDC estimates are that the PCMMs will ship well over twice as many machines (distributed throughout Size Classes 5, 6, and 7) as the 80 shipped in 1977. If PCMM activity continues at its current pace, IDC estimates show that processors from these companies could account for some 20% of IBM's installed base by 1980 303Xs plus 370/148s and above.

And this market is large. During the four-year period 1977-1980, IDC estimates that IBM and the PCMMs will ship some 9,000 or more of these systems world-

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wide. Competitors for this business, to date, include Amdahl, the company that started it all, Itel with processors from Hitachi as well as National Semiconductor, Control Data with the Omega, and Magnuson Systems. Other companies with new breeds of superminis may take cracks at portions of the market, as well.

The big question: How long will IBM let its operating system be in the public domain and therefore assessible to the PCMMs? The answer is not simple, and naturally depends on what IBM is planning.

It seems clear to EDP/IR that IBM's eventual direction will be toward memory-oriented hardware, surrounded by both general- and special-purpose processors. Indeed, one possible step in this direction would be announcement of a new data base operating system combined with new hardware (a new memory technology) that could be shared with several 303X processors.

Meanwhile, IBM has the option and in fact is headed toward separately pricing more of its software. So-called selectable units have established the precedent of pricing portions of the operating system separately; and, of course, special packages, including some fairly complex ones, have been charged for separately for some time. And any move that shifts the total customer payment from hardware to software also affects margins for the PCMMs, which would have to make allowances for their customers to acquire the IBM offering.

Furthermore -- through its use of microcode on the 303X and its MVS Systems Extension -- IBM has already staked out areas that could affect PCMM compatibility. (Internally, EDP/IR understands, IBM talks of systems that are represented as being compatible!) Gradually, the scenario goes, IBM users would follow a path -- paved with microcode and unbundled software -- so far that PCMM offerings are no longer as compatible as they are today. In the future, it seems to EDP/IR some of these competitors will be more compatible than others.

The peripheral picture

One development expected -- if not overdue -- from IBM is a new high-capacity disk with advanced features . . . perhaps ones that can be activitated only via microcode available only on selected mainframes. At first glance this technique would seem reminiscent of the 2314A, 2319, and integrated controllers that still are the focal point of IBM's antitrust clashes with the peripherals companies. But if enough new technology were involved, this approach could be clouded.

The market is ripe. Demand appears to be nearly as insatiable as that for mainframes and main memory, and IBM is expected to enhance its fixed media (3350) drives with at least double current capacities. This would erode the 3330 base and impact all manufacturers of that technology.

Two other products are expected from IBM, probably within the next year. A new, smaller mass storage system -- probably based on 3850 technology -- would open a broader group of users -- including medium-scale users as well as those large-scale users still resisting mass storage -- to the tape-replacement marketplace the 3850 and similar products have pioneered.

And a new tape drive replacement subsystem -- whether half inch or based on the cartridge that is part of the 3850 mass storage system -- would truly offer a new area for activity. Total demand for tape use would not likely be expanded, but such a method of storing more for less would obviously open user pocketbooks.

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The processor picture

The review and forecast tables in this issue -- pages 9-12 -- are consistent with IDC's definitions and its division of processors into three basic varieties, which are illustrated by the three Census tables at the rear of this issue:

- General-purpose systems essentially are those made by (or compatible with) the major manufacturers discussed earlier in this issue and that don't fall into one of the two following categories.

- Minicomputers are used as tools, not solutions, and tend to be marketed in quantities greater than one. They often are supplied to other original equipment manufacturers (OEMs) and may end up as parts of a data entry system, a lab instrument, a piece of control equipment, or a small business computer.

- Small business computers are produced by the general-purpose manufacturers; an additional group of independents; or by minimakers and those that build systems from minis. To the extent this is the case, there is double counting between mini- and small business computers and this overlap has been removed from the summary table on page 9.

Minicomputers: A changing role

Minicomputers are rapidly becoming significant in the value of total shipments of all computers, as the tables illustrate. Long thought of as simply a low-cost, high-volume item, the minicomputer by 1982 will be responsible for nearly 30% of the $30.7 billion value of worldwide shipments of all computers by U.S.-based makers. In 1977, that figure was about 15% of $15.7 billion.

In terms of computers installed, the value of minicomputers will grow 4.7 times between 1977 and 1982 whereas the value of the total base will merely double. Value of yearly shipments will increase accordingly -- minis almost quadrupling while the total nearly doubles. Mini shipments in 1977 were up almost 45% to the $2.3 billion level, exceeding last year's forecast. And by 1982, IDC now forecasts that worldwide mini shipments by U.S.-based manufacturers will top the $9 billion level.

Several interesting trends are underway in the mini area, and are included in the forecasts. Among them:

- The classification of minis is blurred on the low end -- where micro-versions of traditional minicomputers compete with purely personal computers and the small business computers -- and at the high end -- where superminis are being given IBM-compatible software and aimed at the general-purpose market.

- Minis, once best known for their use in problem solving and lab-oriented or computational applications, today are being applied more and more to commercial DP applications. As distrubuted processing and autotransaction continue to develop, such end-user-oriented shipments will account for about half the mini market by the early 1980s.

- Not coincidentally (with superminis and business applications on the rise), the minimakers are finding themselves forced to act more like

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WORLDWIDE MINICOMPUTER MARKET -- 1977 ACTIVITY
(Estimates of Units Shipped and $ Million Revenues; Copyright 1978 by IDC)

Company	Revenues	% Total	76-77 Growth	Units	% Total
Digital Equip.*	$1,100	41%	55%	37,500	43%
Hewlett-Packard*	390	14	28	4,800	5
Data General	279	10	42	10,900+	12
Honeywell	130	5	16	1,600	2
Perkin-Elmer***	86	3	56	1,500	2
General Automation	84	3	12	2,500	3
Texas Instruments	80	3	78	5,000	6
IBM	70	3	--	1,300	2
ModComp	54	2	46	703	1
Computer Automation	52	2	53	5,057	6
Prime	50	2	117	626	1
Univac/Varian	42	2	0	1,200	1
Control Data	36	1	13	330	neg.
Microdata*	38	1	6	996	1
SEL**	35	1	52	150	neg.
Harris	32	1	60	235	neg.
Lockheed	25	1	9	1,579	2
Cincinnati Milacron	18	1	64	1,240	1
Others	99	4	14	10,784	12
TOTAL	$2,700	100%	44%	88,000	100%

*Including terminal & peripheral shipments +Excludes board-only computers
**Excluding older process control systems ***Including terminals; ex-Wanco

computer companies -- supplying full systems and devoting increasing amounts of resources to software development.

Because of such developments, the minicomputer market segment finally seems to be merging into the computer industry mainstream, at least at the upper end. At the lower end, the products more and more will compete with home/hobby market offerings or the computer-on-a-chip components that are becoming available from the semiconductor manufacturers. It's almost as if the minicomputer is disappearing as an entity.

The emerging small business computer

It wasn't until early 1975, when IBM announced System/32, that small business computers existed as a marketplace phenomenum, even though products for the market had been around. The significance of S/32 has been its positioning as a programmerless device . . . truly solution oriented. The wide acceptance of this machine (over 20,000 installed at yearend 1977) defined a significant and distinct new marketplace. U.S. suppliers have installed almost 70,000 computers valued at $2.8 billion. In five years, according to IDC forecasts, these figures will reach nearly 400,000 installed worth over $15 billion at original shipment value. The marketplaceplace shaped up as follows at yearend 1977:

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IBM	20,310	units	worldwide	worth	$853	million =	30.2%
Burroughs	6,320	"	"	"	359	"	12.7
NCR	3,155	"	"	"	200	"	7.0
Sperry Univac	400	"	"	"	18	"	0.6
Digital Equipment	7,036	"	"	"	293	"	10.4
Data General	1,730	"	"	"	129	"	4.6
Other Mini Firms	3,738	"	"	"	191	"	6.8
Wang	15,270	"	"	"	307	"	10.8
Basic/Four	4,622	"	"	"	217	"	7.7
Other Independents	7,317	"	"	"	260	"	9.2
TOTAL	69,898				$2,827		100.0%

The figures for the minicomputer manufacturers include minis shipped to systems houses and reconfigured as small business computers.

Services: The big new factor

Quietly over the past few years, the computer services market has developed into a $4 billion industry that will more than double again during the next five years . . . and the software sector is poised to become the industry's next billion dollar sector. For perspective, users in the U.S. spend about half as much on software and services as they do on hardware . . . and about one-third as much as for salaries. Savings in salary dollars, in fact, has been one of the prime moving factors behind the shift to computer services and outside software.

Eight major vendors paced the market in 1977 with more than $100 million in revenues each. These range from Control Data with more than $300 million of its sales from services through more specialized firms. Computer Sciences generated $263 million in software and services revenues, ADP was at the same level in 1977 and is pioneering the move into including computers along with service offerings. The others are EDS, GE's ISBD, SDC, Tymshare, and McAuto. Large user organizations -- banks, oil and insurance companies -- are moving into services. And the biggest unknown is IBM. It obviously will create markets as it spearate software costs from hardware in competing with PCMMers. Observers ask if it will enter the services fray after 1979 when legal restrictions are removed.

REVENUES OF COMPUTER SERVICES AND SOFTWARE COMPANIES
(Copyright 1978 by International Data Corporation)

Product	1977	Growth/Year	1982
Processing Services	$4,185M	17%	$ 9,000M
Packaged Software	500	28	1,685
Custom Software & Consulting	605	8	900
Facilities Management	575	13	1,050
TOTAL	$5,865	17%	$12,635

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COMPUTER MARKET SUMMARY -- (U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	67,350	253,700	$ 11,880	$ 58.8
1975	75,200	315,900	12,040	67.2
1976	96,340	388,890	13,070	76.3
1977	133,280	496,620	15,680	88.2
1978	168,450	640,910	18,730	101.9
1979	210,600	825,200	21,020	117.3
1980	262,800	1,055,550	23,720	134.9
1981	328,550	1,346,600	27,140	155.0
1982	405,950	1,709,550	30,680	178.1
		UNITED STATES		
1974	46,100	167,100	$ 7,000	$ 33.6
1975	50,600	207,100	6,460	37.9
1976	64,840	255,540	6,870	43.0
1977	88,960	325,000	8,730	49.7
1978	112,000	416,200	10,610	57.5
1979	140,300	532,650	11,970	66.2
1980	174,100	677,400	13,570	76.3
1981	216,050	858,800	15,550	87.8
1982	266,650	1,084,850	17,560	101.0
		INTERNATIONAL		
1974	21,250	86,600	$ 4,880	$ 25.2
1975	24,600	108,800	5,580	29.3
1976	31,500	133,350	6,200	33.3
1977	44,320	171,620	6,950	38.5
1978	56,450	224,710	8,120	44.4
1979	70,300	292,550	9,050	51.1
1980	88,700	378,150	10,150	58.6
1981	112,500	487,800	11,590	67.2
1982	139,300	624,700	13,120	77.1

This is the total of all general-purpose computers, minis, small business computers (SBCs), and "other" systems such as IBM's S/7. Minis used in SBCs are subtracted from the total to eliminate double counting. Details on the three major types of computers are found in tables elsewhere in this issue. Note that the general-purpose and SBC tables are mutually exclusive, but the minicomputer table includes computers subsequently shipped to users -- by the minimakers themselves or by systems houses -- as small business computers.

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GENERAL-PURPOSE COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	16,000	111,300	$ 10,700	$ 54.2
1975	13,800	115,400	10,410	61.1
1976	14,300	111,700	10,630	68.0
1977	17,500	111,300	12,250	76.8
1978	17,000	116,200	14,100	86.2
1979	16,100	121,400	14,900	96.0
1980	17,000	127,100	15,800	106.4
1981	17,900	132,100	17,000	117.2
1982	17,900	136,700	18,000	128.6
		UNITED STATES		
1974	8,600	61,500	$ 6,200	$ 30.2
1975	6,700	62,100	5,410	33.6
1976	7,100	59,500	5,330	37.4
1977	8,900	58,100	6,460	42.1
1978	8,800	59,700	7,500	47.1
1979	8,300	61,400	7,900	52.2
1980	8,800	63,600	8,400	57.7
1981	9,300	65,500	9,000	63.4
1982	9,300	67,200	9,500	69.4
		INTERNATIONAL		
1974	7,400	49,800	$ 4,500	$ 24.0
1975	7,100	53,300	5,000	27.5
1976	7,200	52,200	5,300	30.6
1977	8,600	53,200	5,790	34.7
1978	8,200	56,500	6,600	39.1
1979	7,800	60,000	7,000	43.8
1980	8,200	63,500	7,400	48.7
1981	8,600	66,600	8,000	53.8
1982	8,600	69,500	8,500	59.2

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MINICOMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	47,500	121,500	$ 940	$ 2.7
1975	51,900	171,000	1,185	3.8
1976	63,800	230,400	1,600	5.3
1977	88,000	311,700	2,315	7.4
1978	116,200	418,300	3,195	10.3
1979	150,000	556,300	4,265	14.3
1980	190,000	730,300	5,600	19.5
1981	240,000	952,400	7,235	26.3
1982	300,000	1,231,100	9,135	34.8
		UNITED STATES		
1974	34,700	89,700	$ 630	$ 2.0
1975	36,900	122,800	735	2.6
1976	45,900	162,700	1,025	3.5
1977	61,600	215,800	1,550	4.8
1978	80,200	284,100	2,170	6.7
1979	103,500	372,600	2,855	9.3
1980	129,200	482,400	3,640	12.5
1981	160,800	620,400	4,630	16.7
1982	200,000	792,900	5,755	21.8
		INTERNATIONAL		
1974	12,800	31,800	$ 310	$ .7
1975	15,000	48,200	450	1.2
1976	17,900	67,700	575	1.8
1977	26,400	95,900	765	2.6
1978	36,000	134,200	1,025	3.6
1979	46,500	183,700	1,410	5.0
1980	60,800	247,900	1,960	7.0
1981	79,200	332,000	2,605	9.6
1982	100,000	438,200	3,380	13.0

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SMALL BUSINESS COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	4,150	6,200	$ 200	$ .3
1975	10,600	16,800	400	.7
1976	21,600	38,400	870	1.6
1977	31,500	69,900	1,220	2.8
1978	39,950	107,900	1,590	4.3
1979	50,200	155,000	2,050	6.2
1980	63,100	213,000	2,580	8.5
1981	79,900	286,000	3,250	11.5
1982	99,800	377,000	3,980	15.1
		UNITED STATES		
1974	3,000	4,500	$ 150	$ .2
1975	7,900	12,400	300	.5
1976	14,500	26,900	570	1.1
1977	21,350	48,250	800	1.9
1978	26,450	73,400	1,050	2.9
1979	32,600	104,000	1,350	4.2
1980	41,300	142,000	1,700	5.7
1981	52,600	190,000	2,150	7.7
1982	65,800	250,000	2,600	10.0
		INTERNATIONAL		
1974	1,150	1,700	$ 50	$ .1
1975	2,700	4,400	100	.2
1976	7,100	11,500	300	.5
1977	10,150	21,650	420	.9
1978	13,500	34,500	540	1.4
1979	17,600	51,000	700	2.0
1980	21,800	71,000	880	2.8
1981	27,300	96,000	1,100	3.8
1982	34,000	127,000	1,380	5.1

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GENERAL-PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language.

Instead of being pegged to constantly shifting average values, size classes are based on currently marketed IBM products and other manufacturers' models that compete with them, e.g., a computer in Size Class 7 would compete with an IBM 3033 or 168. (Other classes can be checked under IBM's column.) Note that many mainframe manufacturers also offer smaller systems that are included in the Small Business Computer Census. An "x" in the last column means none on order from the original manufacturer.

AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Amdahl	470V/5	6	$ 66,000	9/77	5	1	6	30
	470V/6, II	7	$ 99,000	6/75	64	16	80	65
	470V/7	7	$ 98,000	8/78	-	-	-	6
	Total				69	17	86	101
Burroughs	B273/500	3	$ 6,600	11/61	405	265	670	X
	B1710	2	$ 2,600	8/72	1,290	660	1,950	)
	B1720	3	$ 6,700	2/73	510	225	735	) 550
	B1800	3	$ 5,200	5/77	35	7	42	)
	B2500	4	$ 10,400	2/67	56	70	126	X
	B2700	4	$ 10,400	8/72	400	200	600	X
	B2800	4	$ 11,900	12/76	21	23	44	100
	B3500	4	$ 19,000	5/67	300	245	545	X
	B3700	4	$ 25,000	11/72	360	255	615	X
	B3800	4	$ 17,800	4/77	10	5	15	130
	B45/4700	5	$ 31,500	10/71	350	135	485	X
	B4800	5	$ 36,000	9/76	40	14	54	100
	B5500	5	$ 35,000	3/63	43	14	57	X
	B5700	5	$ 33,500	12/70	7	8	15	X
	B6700	6	$ 66,000	11/69	155	110	265	X
	B6800	5	$ 47,500	6/77	17	8	25	75
	B7700	7	$141,000	8/73	31	13	44	13
	B7800	7	$150,000	8/78	-	-	-	12
	Total				4,030	2,257	6,287	980
CDC	Omega 480-1	4	$ 10,000	6/77	8	-	8	25
	Omega 480-2	5	$ 14,200	5/78	-	-	-	15
	Cyber-71	4	$ 19,800	7/76	3	6	9	5
	Cyber-171	4	$ 26,500	8/77	1	-	1	5
	Cyber-72	5	$ 40,500	10/71	14	50	64	X
	Cyber-172	6	$ 47,500	7/75	15	35	50	10
	Cyber-73	6	$ 61,000	3/72	19	34	53	X
	Cyber-173	6	$ 77,000	9/75	7	37	44	15
	Cyber-74	7	$135,000	3/72	30	17	47	X
	Cyber-174	6	$ 92,000	9/75	10	14	24	25
	Cyber-175	7	$157,000	8/75	14	8	22	10
	Cyber-76	7	$180,000	3/72	7	10	17	3
	Cyber-176	7	$184,000	1/78	-	-	-	5
	G-20	4	$ 19,600	4/61	4	-	4	X
	1604	6	$ 42,000	1/60	8	-	8	X
	31/3150	4	$ 9,800	12/64	48	19	67	X
	3170	5	$ 22,000	12/70	19	19	38	X
	3200	4	$ 14,700	5/64	33	24	57	X
	3300	5	$ 34,500	9/65	86	59	145	X
	3400	5	$ 23,700	11/64	4	3	7	X
	3500	5	$ 31,000	1/69	30	10	40	X
	3600	6	$ 49,000	6/63	16	13	29	X
	3800	6	$ 60,000	12/65	12	2	14	X
	6200	6	$ 42,500	11/70	1	3	4	X
	6400	6	$ 63,000	5/66	50	40	90	X
	6500	6	$ 86,000	12/67	15	14	29	X
	6600	7	$120,000	8/64	47	22	69	X
	6700	7	$140,000	7/70	3	-	3	X
	7600	7	$195,000	1/69	23	6	29	X
	Star-100	7	$280,000	12/74	4	-	4	0
	Total				531	445	976	118
Cray	Cray 1A	7	$215,000	4/76	2	1	3	4
DEC	2040	4	$ 10,400	6/76	90	85	175	120
	2050	4	$ 18,800	5/77	20	3	23	25
	PDP-6	4	$ 10,000	10/64	7	1	8	X
	1040/50	4	$ 17,300	10/67	165	140	305	X
	1060/70	5	$ 19,500	6/72	120	95	215	20
	1080/90	6	$ 27,000	6/75	60	32	92	30
	Total				462	356	818	195
Honeywell	H-61/58	2	$ 2,200	6/74	115	660	775	) 400
	H-61/60	2	$ 3,200	6/74	78	830	908	)
	H-Level 62	3	$ 4,900	10/74	440	470	910	450
	H-64/20	4	$ 9,800	10/74	195	310	505	)
	H-64/30	4	$ 11,000	11/76	5	30	35	)
	H-64/40	4	$ 13,900	10/74	34	65	99	) 250
	H-64/50	4	$ 15,700	7/77	1	2	3	)
	H-64/60	4	$ 21,000	6/77	-	7	7	)
	H-66/05/07	4	$ 17,600	10/76	44	34	78	60
	H-66/10/17	5	$ 27,500	6/75	56	75	131	75
	H-66/20/27	5	$ 38,000	11/74	84	121	205	60
	H-66/40	6	$ 63,000	10/74	32	35	67	) 35
	H-66/60	6	$ 91,000	10/74	40	14	54	)
	H-66/80	7	$112,000	10/74	12	9	21	) 20
	H-68/80	7	$100,000	10/74	7	2	9	)
	S-60 Subtotal				1,143	2,664	3,807	1,350
	C-50	2	$ 1,900	8/70	240	1,090	1,330	X
	C-100	3	$ 4,900	4/66	85	800	885	X
	C-200	4	$ 10,000	4/61	115	28	143	X
	C-400	4	$ 16,000	5/64	205	205	410	X
	C-600	6	$ 80,000	4/65	34	26	60	X
	C-6023/25	5	$ 32,000	11/73	31	26	57	X
	C-6030/40	5	$ 42,000	6/71	54	135	189	X
	C-6050/60	6	$ 70,000	7/71	86	64	150	X
	C-6070/80	6	$108,000	7/71	50	27	77	X
	C-6180	7	$108,000	2/74	5	-	5	X
	Gamma 10	2	$ 2,500	7/64	-	550	550	X
	Gamma 30	4	$ 10,000	2/62	-	52	52	X
	C-Subtotal				905	3,003	3,908	X
	H-105/115	3	$ 6,400	3/70	270	290	560	X
	H-110/120	3	$ 5,400	1/66	125	125	250	X
	H-125	4	$ 8,600	12/67	22	145	167	X
	H-200	3	$ 7,500	3/64	250	120	370	X
	H-2020	3	$ 3,700	2/73	455	150	605	X
	H-2030	3	$ 6,000	1/73	105	56	161	X
	H-2040	4	$ 13,200	4/72	240	140	380	X
	H-1015	4	$ 14,500	4/71	30	27	57	X
	H-2050	4	$ 20,000	4/72	110	95	205	X
	H-1200	4	$ 14,600	2/66	220	91	311	X
	H-2015	4	$ 21,500	2/71	37	26	63	X
	H-2060	4	$ 20,500	4/72	42	21	63	X
	H-2200	4	$ 20,000	1/66	93	34	127	X
	H-2070	5	$ 34,500	5/72	35	2	37	X
	H-3200	5	$ 28,500	2/70	91	36	127	X
	H-4200	5	$ 46,500	9/68	12	3	15	X
	H-8200	6	$ 75,000	2/69	14	10	24	X
	H-4/1400	4	$ 14,000	12/61	12	16	28	X
	H-8/1800	5	$ 35,000	12/60	10	13	23	X
	H-Subtotal				2,173	1,400	3,573	X
	Total				4,221	7,067	11,288	1,350

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AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
IBM	System/3-4	2	$ 1,300	6/76	510	140	650	400
	System/3-6	2	$ 1,800	12/70	940	915	1,855	X
	System/3-8	2	$ 2,000	6/75	5,160	4,760	9,920	2,800
	System/3-10	2	$ 2,600	1/70	8,020	5,700	13,720	X
	System/3-12	3	$ 3,600	3/76	4,450	2,580	7,030	3,500
	System/3-15	3	$ 6,500	3/74	2,950	1,770	4,720	700
	S/3 Subtotal				22,030	15,865	37,895	7,400
	3031	6	$ 62,000	3/78	-	-	-	500
	3032	6	$111,000	3/78	-	-	-	500
	3033	7	$178,000	3/78	-	-	-	500
	370/115	3	$ 9,100	4/74	1,150	2,600	3,750	X
	370/125	4	$ 12,800	6/73	1,100	2,020	3,120	X
	370/135	4	$ 20,500	5/72	1,820	2,550	4,370	X
	370/138	4	$ 20,000	11/76	1,270	1,220	2,490	2,200
	370/145	5	$ 38,500	7/71	1,600	1,660	3,260	X
	370/148	5	$ 34,500	3/77	860	820	1,680	1,800
	370/155	6	$ 70,000	2/71	475	325	800	X
	370/158	6	$100,000	5/73	1,500	1,400	2,900	X
	370/165	7	$130,000	6/71	120	42	162	X
	370/168	7	$185,000	7/73	525	305	830	X
	370/195	7	$275,000	3/71	12	4	16	X
	370 Subtotal				10,432	12,946	23,378	5,500
	360/20	3	$ 2,900	12/65	1,080	1,900	2,980	X
	360/22	3	$ 3,700	7/71	100	120	220	X
	360/25	3	$ 8,300	10/68	100	390	490	X
	360/30	4	$ 11,200	6/65	1,730	900	2,630	X
	360/44	4	$ 18,700	7/66	44	42	86	X
	360/40	4	$ 19,000	6/65	1,100	780	1,880	X
	360/50	5	$ 33,500	8/65	500	275	775	X
	360/65	6	$ 72,000	11/65	400	150	550	X
	360/67	7	$146,000	6/66	19	10	29	X
	360/75	7	$122,000	1/66	25	17	42	X
	360/85	7	$183,000	10/69	1	2	3	X
	360/9X	7	$197,000	11/67	10	5	15	X
	360 Subtotal				5,109	4,591	9,700	X
	1130	2	$ 2,600	2/66	1,350	1,200	2,550	X
	1401	3	$ 3,700	9/60	500	440	940	X
	1401-G	2	$ 2,400	5/64	14	9	23	X
	1401-H	2	$ 1,750	6/67	5	-	5	X
	1410	4	$ 17,100	11/61	33	26	59	X
	1440	3	$ 4,700	4/63	66	83	149	X
	1460	4	$ 10,000	10/63	14	10	24	X
	1620	3	$ 2,700	9/60	110	91	201	X
	7010	5	$ 25,500	10/63	6	3	9	X
	7030	7	$160,000	5/61	2	-	2	X
	7040/44	5	$ 30,000	6/63	9	13	22	X
	7070/74	5	$ 27,000	3/60	77	11	88	X
	7080	6	$ 60,000	8/61	24	-	24	X
	7090/94	6	$ 71,000	8/60	32	9	41	X
	Subtotal				2,242	1,895	4,137	X
	Total				39,813	35,297	75,110	12,900
Itel	AS/4	5	$ 18,800	6/77	20	-	20	45
	AS/5	6	$ 37,500	3/77	35	5	40	75
	AS/6	6	$ 52,000	4/78	-	-	-	15
	Total				55	5	60	135
NCR	8350	2	$ 2,900	6/77	10	-	10	120
	8430	3	$ 4,200	5/78	-	-	-	50
	8450	3	$ 6,200	11/77	3	-	3	140
	8550	3	$ 10,000	4/76	260	150	410	200
	8560	4	$ 12,100	11/77	5	-	5	100
	8570	4	$ 15,600	5/76	30	30	60	60
	8580	5	$ 30,000	8/78	-	-	-	15
	Century-50	2	$ 1,700	2/71	435	45	480	X
	Century-75	2	$ 2,200	7/76	90	-	90	X
	Century-100	3	$ 3,300	9/68	315	695	1,010	X
	Century-101	3	$ 4,000	10/72	975	740	1,715	X
	Century-151	3	$ 5,100	2/75	290	100	390	X
	Century-200	4	$ 7,600	9/69	260	395	655	X
	Century-201	4	$ 11,200	8/74	300	155	455	X
	Century-251	4	$ 20,000	11/73	75	74	149	X
	Century-300	5	$ 25,000	2/72	85	83	168	X
	315	3	$ 3,400	5/62	85	125	210	X
	315-RMC	4	$ 10,400	9/65	20	20	40	X
	Total				3,238	2,612	5,850	685
Singer	System 10	2	$ 2,700	10/70	1,450	1,300	2,750	X
Sperry-Univac	III	4	$ 27,000	8/62	80	28	108	X
	SS-80/90	3	$ 8,500	8/58	-	5	5	X
	418 I/II	4	$ 10,700	6/63	47	52	99	X
	418 III	4	$ 40,500	6/69	44	88	132	X
	491/492	5	$ 28,500	12/61	13	10	23	X
	494	6	$ 79,000	2/66	61	58	119	X
	1004	2	$ 1,100	2/63	255	230	485	X
	1005	2	$ 2,000	4/66	205	82	287	X
	1050	3	$ 9,300	9/63	120	45	165	X
	1106	6	$ 44,000	12/69	86	225	311	X
	1107	6	$ 60,000	10/62	4	8	12	X
	1108	7	$ 91,000	9/65	152	91	243	X
	1110	7	$138,000	6/72	58	75	133	X
	9200	2	$ 2,300	6/67	545	615	1,160	X
	9300	3	$ 5,000	9/67	440	470	910	X
	9400/80	4	$ 12,500	5/69	230	420	650	X
	90/25	3	$ 3,800	8/77	50	50	100	350
	90/30	3	$ 7,600	2/75	625	850	1,475	500
	90/60	4	$ 23,000	1/74	92	97	189	50
	90/70/9700	5	$ 29,000	8/72	16	36	52	10
	90/80	5	$ 65,000	12/76	14	3	17	25
	1100/10	5	$ 35,500	4/76	41	48	89	65
	1100/20	5	$ 47,000	4/75	19	32	51	20
	1100/40	6	$ 78,000	7/75	35	45	80	45
	1100/80/81/82	6	$112,000	3/77	3	5	8	15
	1100/83	7	$195,000	6/78	-	-	-	2
	1100/84	7	$238,000	6/78	-	-	-	2
	Subtotal				3,235	3,668	6,903	1,084
	301	4	$ 6,900	10/60	33	4	37	X
	501	5	$ 16,600	6/59	4	-	4	X
	3301	5	$ 23,500	7/64	41	-	41	X
	Spectra 70/15	3	$ 4,600	9/65	3	-	3	X
	Spectra 70/25	3	$ 7,800	9/65	-	7	7	X
	Spectra 70/35	4	$ 14,400	1/67	55	1	56	X
	Spectra 70/45	5	$ 27,000	11/65	155	8	163	X
	Spectra 70/46	5	$ 44,500	11/68	28	1	29	X
	Spectra 70/55	5	$ 42,500	11/68	5	-	5	X
	Spectra 70/60	6	$ 50,000	9/70	25	-	25	X
	Spectra 70/61	6	$ 55,000	3/71	4	-	4	X
	Spectra 1600	3	$ 4,300	1/69	34	-	34	X
	Spectra 70/2	4	$ 13,900	7/71	34	-	34	X
	Spectra 70/3	4	$ 22,500	10/71	17	-	17	X
	Spectra 70/6	6	$ 36,500	10/71	34	-	34	X
	Spectra 70/7	6	$ 44,500	10/71	22	-	22	X
	Subtotal				494	21	515	X
	Total				3,729	3,689	7,418	1,084
Xerox	Sigma 5	4	$ 14,600	8/67	122	21	143	X
	Sigma 6	4	$ 23,500	11/70	32	14	46	X
	Sigma 7	5	$ 28,500	12/66	58	9	67	X
	Sigma 8	4	$ 21,500	9/71	5	6	11	X
	Sigma 9	6	$ 54,000	11/71	68	30	98	X
	530	3	$ 4,000	8/73	105	38	143	X
	550/560	4	$ 14,200	11/74	34	5	39	X
	940	5	$ 26,000	4/66	39	3	42	X
	9300	3	$ 8,500	11/64	15	4	19	X
	Total				478	130	608	X
TOTAL					58,078	53,176	111,254	17,552

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MINICOMPUTER CENSUS

The categorization of certain computers as "small business computers" is based on marketplace definitions as perceived by IDC. SBCs are those small general-purpose computers marketed by the major mainframers and their competitors to smaller businesses and first-time users. They include offerings from the major mainframers (such as IBM's System/32); products such as DEC's Datasystem/300 from the minimakers but aimed at commercial first-time users; equipment from firms (such as Qantel) that manufacture only SBCs; and products from companies that assemble systems from other's minicomputers as Basic/Four did before beginning its own manufacturing operations.

AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	BITS PER WORD	SIZE CLASS	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1978 INSTALLATION
Artronix	PC-12/7	12	T	20	45	9/71	135	40	175	X
Bytronix	Series 1000	16	T	6		12/77	5	5	10	200
	Series 2000	16	T	8		/78	0	0	0	NA
Century Computer Corp.	C-200	8	T	5	7	2/71	150	0	150	NA
Cincinnati Milacron	CIP/2000 Series	8	T	4	17	7/69	) 3,050	) 480	) 3,530	) 1,800
	CIP/4000	16	T	4	17	12/76	)	)	)	)
Compiler Systems, Inc.*	CSI-16	16	T	11	20	11/70	80	10	90	X
	CSI-24	24	T	15	30	12/70	35	5	40	X
Computer Automation, Inc.	108/208/808	8	T	5	11	4/68	280	30	310	X
	116	16	T	8	16	8/70	200	50	250	X
	216	16	T	8	20	7/69	350	45	395	X
	816	16	T	10	15	12/68	40	5	45	X
	Alpha-8, Naked Mini-8	8	T	2	3	5/72	) 4,060	) 1,087	) 5,147	X
	Alpha-16, Naked Mini-16	16	T	3	8	10/71	)	)	)	400
	LSI-2/10,2/20,2/60	16	T,T,S	2	5	12/73	12,100	1,279	13,379	3,500
	LSI-3/05	16	M	1	2	2/76	830	225	1,055	900
	LSI-4/10	16	M	1	2	6/77	44	10	54	)
	LSI-4/30	16	T	2	4	6/77	30	8	38	) 1,000
	LSI-4/90	16	S	4	9	6/77	10	2	12	)
	Total						17,944	2,741	20,685	
Computer Talk, Inc.	CT-400	16	T	25	30	9/75	5	0	5	12
	CT-407	16	T	32	37	12/77	1	0	1	4
Control Data Corp.	1700	16+2	S	37	160	3/66	)	)	)	X
	1700-SC	16+2	S	20	60	9/70	)	)	)	X
	System 17	16+2	T	14	39	2/74	) 970	) 610	) 1,580	)
	Cyber-18-10	16+2	T	14	40	/76	)	)	)	) 350
	Cyber-18-20	16+2	T	16	75	/76	)	)	)	)
	Cyber-18-30	16+2	S	110	116	9/76	)	)	)	)
	Elbit-100	12	T	6	8	6/67	5	445	450	X
Data General Corp.	Nova	16	T	6	12	2/69	750	400	1,150	X
	Micronova	16	M	2	4	11/76	1,220	310	1,530	2,500
	Nova-2 Series	16	T	3	8	10/73	5,500	1,800	7,300	500
	Nova-3/4	16	T	2	4	1/76	1,550	250	1,800	)
	Nova-3/12	16	T	12	17	1/76	4,400	1,550	5,950	) 8,900
	Nova-3/D	16	T	12	35	10/76	500	225	725	)
	Nova-800/820	16	T	7	34	3/71	2,150	700	2,850	) 350
	Nova-830/840	16	S	16	43	7/73	625	350	975	)
	Nova-1200 Series	16	T	3	11	12/70	8,300	3,300	11,600	400
	Supernova, SC	16	T	9	27	4/70	300	150	450	X
	Eclipse-S/100	16	S	12	30	2/75	270	60	330	)
	Eclipse-S/130	16	S	11	30	8/77	400	50	450	) 1,300
	Eclipse-S/200	16	S	16	48	2/75	1,150	450	1,600	)
	Eclipse-S/230	16	S	15	40	10/76	630	100	730	) 1,100
	Eclipse-C/300	16	S	24	115	2/75	310	70	380	)
	Eclipse-C/330	16	S	30	110	11/76	310	40	350	) 550
	Eclipse-M/600	16	S	164		5/78	0	0	0	50
	Subtotal						28,365	9,805	38,170	
(Digital Computer Controls)	D-112	12	T	3	12	8/70	700	400	1,100	X
	D-116	16	T	5	10	11/71	7,450	1,350	8,800	X
	D-416/616	16	T/S	3	7	9/75	125	15	140	X
	Mod-5	16+2	T	3	6	2/76	80	10	90	X
	Subtotal						8,355	1,775	10,130	
	Total						36,720	11,580	48,300	
Datamate Computer Systems*	DM-16	16	T	17	26	11/69	12	0	12	X
	DM-70	16	T	9	15	12/70	25	0	25	X
	DM-70/ROM	16	T	4	6	10/70	NA	0	NA	X
	ECP-18	18	T	14	16	11/66	21	0	21	X
Datum	Enhancer E1/16	16	T	8	15	3/76	15	3	18	20
Digiac Corp.*	3060		T	9	13	1/70	70	20	90	X
	3080	25	T	20	25	12/64	14	2	16	X
Digital Equipment Corp.	PDP-8/a, e, f, m	12	T	4	14	4/71	23,900	9,850	33,750	7,000
	PDP-8/i, l, s	12	T	8	27	5/65	5,765	3,685	9,450	X
	PDP-9, 9L	18	T	35	50	12/66	290	160	450	X
	PDP-11/04, 05, 10, 15, 20	16	T	5	15	3/70	19,050	11,400	30,450	6,000
	PDP-11/34, 35, 40	16	T	9	35	1/73	9,550	4,950	14,500	8,000
	PDP-11/45, 50, 55	16	S	24	85	4/72	2,550	1,100	3,650	500
	PDP-11/60	16	S	26	70	6/77	120	100	220	800
	PDP-11/70	16	S	60	160	7/75	2,050	800	2,850	2,400
	PDP-11/03, LSI-11	16	M	2	2	6/75	18,650	2,850	21,500	25,000
	PDP-12	12	T	13	45	4/69	510	255	765	X
	PDP-15, XVM	18	T	15	80	2/70	550	320	870	0
	VAX-11/780	32	S	128		/78	0	0	0	100
	Total						82,985	35,470	118,455	
Digital Scientific Corp.	Meta-4/4000	16	S	29	90	4/70	140	15	155	X
	Meta-4/5020	16	S	50	99	4/78	0	0	0	60
	Meta-4/5010	16	S	21	40	7/78	0	0	0	24
Electronic Associates, Inc.	Pacer-100	16	T	15	40	5/72	132	108	240	NA
Foto-Mem, Inc.*	Centaur-100	8	T	6	20	4/70	25	0	25	X
General Automation Inc.	GA-18/30	16	S	18	50	7/69	790	210	1,000	0
	SPC-12	8	T	4	16	1/68	2,900	800	3,700	0
	SPC-16	16	T	5	25	5/70	5,200	2,250	7,450	1,200
	16/110/220	16	M	1	3	12/75	770	130	900	700
	16/330	16	T	3	10	1/76	185	15	200	200
	16/440	16	S	9	30	7/75	640	260	900	200
	16/550	16	S			3/78	0	0	0	50
	Total						10,485	3,665	14,150	
GRI Computer	909 Series	16	T	4	9	1/70	320	150	470	X
	99/30	16	T	5	15	6/72	578	268	846	200
	99/40	16	T	6	17	6/72	117	68	185	NA
	99/10	16	T	3	5	6/72	18	0	18	NA
	Total						1,033	486	1,519	
GT&E	Tempo I	16	T	14	36	1/70	160	40	200	NA
	Tempo II	16	T	6	10	6/72	950	50	1,000	NA
Harris	6024/1	24	S	69	135	5/69	22	0	22	X
	6024/3	24	S	49	90	2/70	119	0	119	X
	Slash 4	24	S	24	110	8/73	207	18	225	35
	Slash 5	24	S	16	50	5/72	400	24	424	85
	Slash 6	24	S	20	70	12/76	44	4	48	50
	Slash 7	24	S	45	180	10/75	14	1	15	5
	Series 100	24	S	85	190	10/75	86	13	99	70
	Series 200	24	S	179	240	10/75	39	4	43	25
	Total						931	64	995	

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AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	BITS PER WORD	SIZE CLASS	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1978 INSTALLATION
Hewlett-Packard	2100A	16	T	7	15	6/71	7,850	3,350	11,200	100
	2100S	16	T	16	35	8/73	1,775	1,375	3,150	100
	2114-A/B	16	T	9	16	5/68	1,035	495	1,530	X
	2115-A	16	T	15	26	11/67	240	100	340	X
	2116-A/B/C	16	T	20	40	11/66	1,220	550	1,770	X
	21MX-K	16	M	2	4	6/76	300	200	500	400
	21MX-M	16	T	4	15	6/74	6,200	3,200	9,400	3,500
	21MX-E	16	T	6	20	1/77	1,200	700	1,900	2,500
	3000	16	S	100	185	11/72	) 600	) 400	) 1,000	) 650
	3000-II	16	S	100	185	4/76	)	)	)	)
	Total						20,420	10,370	30,790	
HIS - GE/PAC	30	8	T	7	35	5/69	225	50	275	X
	3010, 2	16	T	13	90	5/70	25	1	26	X
Honeywell	112	12	T	5	10	11/69	222	48	270	X
	116/316/416/516	16	T	8	62	10/66	2,405	1,295	3,700	X
	700 Series	16	T	16	65	6/72	1,850	1,450	3,300	300
	164X Series	16	T	144	440	12/69	20	8	28	X
	6/06	16	T	8	42	1/76	)	)	)	)
	6/34	16	T	3	18	1/76	) 750	) 450	) 1,200	) 1,600
	6/36	16	T	8	35	1/76	)	)	)	)
	6/43	16	T	10	45	1/77	)	)	)	)
	Total						5,497	3,302	8,799	
Information Technology, Inc.*	4900/10	16	T	10	20	10/65	25	0	25	X
Interdata	1	8	T	4	11	9/70	210	77	287	X
(Perkin-Elmer)	2, 3, 4, 5	16	T	9	21	5/67	614	153	767	X
	13, 15, 16, 18	16	T	15	33	9/69	14	14	28	X
	50, 55	16+1	T	7	33	4/72	133	40	173	X
	70	16	T	9	65	12/71	1,057	340	1,397	30
	74	16	T	3	34	2/73	300	56	356	X
	80, 85	16	T	15	50	7/72	70	18	88	X
	5/16	16	M	1	5	1/77	55	25	80	100
	6/16	16	T	2	15	1/76	675	265	940	800
	7/16	16	T	3	18	2/74	3,145	788	3,933	900
	8/16	16	T	4	25	1/77	90	40	130	175
	7/32	32	S	10	35	7/74	640	192	832	350
	8/32	32	S	55	160	6/75	265	99	364	250
	Total						7,268	2,107	9,375	
IBM Corp.	Series/1	16	T	10	50	11/76	1,300	100	1,400	4,000
Keronix	IDS-16/8	16	T	5	5	4/74	)	)	)	)
	IDS-16/10	16	T	4	5	4/74	) 1,450	) 50	) 1,500	) 1,700
	IDS-16/12	16	T	4	4	4/74	)	)	)	)
Lockheed Electronics	LEC-16	16	T	11	22	3/69	495	55	550	) 30
Co., Inc.	LEC-Jr	16	T	8	16	1/71	1,975	375	2,350	)
	SUE	16	T	6	11	9/72	2,240	360	2,600	400
Microdata Corp.	400	8	T	3	4	1/70	155	0	155	X
	800 Series	8	T	6	11	5/69	2,055	1,380	3,435	X
	1600	8	T	5	11	2/72	6,603	1,132	7,735	1,100
	3200/3230	16	S	8	14	3/74	110	100	210	20
	Micro One	8	M	1	3	11/74	800	120	920	X
	Total						9,723	2,732	12,455	
Minicomp*	MD-708	8	T	5	7	8/70	50	0	50	X
Modular Computer	Modcomp-I	16	T	2	9	10/71	690	140	830	50
Systems	Modcomp-II	16	T	4	40	3/71	1,535	395	1,930	650
	Modcomp-III	16	S	13	44	12/70	70	5	75	X
	Modcomp-IV	16/32	S	42	100	5/74	255	100	355	100
	Classic 7860	16/32	S	37	100	1/78	0	0	0	50
	Total						2,550	640	3,190	
Motorola Communications Division	MDP-1000	8	T	8	19	2/69	75	0	75	X
Omnitec (BIT)*	480	8	T	6	17	12/66	195	3	198	X
	483	8	T	9	33	1/70	115	40	155	X
Prime Computer	100	16	T	4	11	4/73	222	582	804	250
	200	16	T	6	22	11/72	311	64	375	100
	300	16	S	12	60	9/73	290	228	518	250
	400/500	16	S	50	152	6/76	120	50	170	200
	Total						943	924	1,867	
Raytheon Data Systems	703	16	T	13	23	10/66	179	33	212	X
	704	16	T	10	18	3/70	690	200	890	X
	706	16	T	19	30	5/69	75	17	92	X
	RDS-500	16	S	10	16	12/73	650	100	750	450
	Total						1,394	350	1,944	
Redcor Corp.*	RC-70	16+2	T	15	30	7/68	100	40	140	X
Sperry-Univac	5201	16	T	6	13	9/68	330	170	500	X
(Varian)	620/a	16	T		75	12/65	120	30	150	X
	620/f, f-100	16	T	10	23	6/70	470	220	690	X
	6201	16/18	T	10	20	12/65	920	380	1,300	X
	620/L & 100c	16	T	5	12	2/71	720	320	1,040	X
	620/L-100	16	T	6	14	6/72	970	480	1,450	200
	R620/1, R622/1	16/18	T	15	29	6/69	175	70	245	20
	V-72	16	T	10	45	2/74	750	330	1,080	200
	V-73	16	S	16	45	11/72	1,190	530	1,720	20
	V-74	16	S	40		5/74	210	90	300	X
	V-75	16	S	39		8/75	120	50	170	X
	V-76	16	S	8		1/76	530	200	730	200
	V-77-200	16	M	2	5	1/77	200	60	260	)
	V-77-400	16	T	5	19	12/76	110	50	160	) 2,500
	V-77-600	16	S	8	40	3/77	150	80	230	)
	Total						6,965	3,060	10,025	
Systems Computer Corp.*	1000	8	T	1	4	1/71	400	200	600	X
Systems Engineering Laboratories	32/35	32	S	30	80	9/76	30	10	40	30
	32/55	32	S	50	125	8/75	230	80	310	120
	32/75	32	S	70	150	3/78	0	0	0	50
Tandem Computers, Inc.	T16	16	S	135	224	5/76	96	8	104	100
Telefile Computer Products	TCF-16	16				/77	NA	NA	NA	NA
Texas Instruments	960-A/B	16	T	4	30	12/71	2,650	1,250	3,900	400
	980-A/B	16	S	5	40	10/72	2,900	1,350	4,250	400
	990/4	16	M	1	5	6/76	3,300	1,300	4,600	4,000
	990/10	16	T	2	15	3/76	1,900	450	2,350	1,800
	Total						10,750	4,350	15,100	
Unicom, Inc.*	CP-8	8	T	3		2/70	343	165	508	X
Unicomp*	Comp-16	16	T	11	29	6/70	26	0	26	X
	Comp-18	18	T	12	38	8/70	38	0	38	X
Westinghouse Electric	P-50	14	T	16	23	8/64	182	40	222	X
	P-2000	16	T	10	27	8/69	111	90	201	X
	2500	16	T	10	30	11/71	274	90	364	100
Xerox*	CE-16, 16/A	16	T	8	23	6/69	35	10	45	X
	Sigma-2	16	T	24	125	12/66	170	80	250	X
TOTAL							231,763	85,470	317,233	

*) Not currently active in manufacturing or marketing of minicomputers.
NA) Data is not available.
X) Indicates minicomputer models not in new production.

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SMALL BUSINESS COMPUTER CENSUS

The categorization of certain computers as "minicomputers" is based on marketplace definitions as perceived by IDC. Minis are general-purpose in design but sold as tools, not just solutions; are available from the makers as complete systems, not just boards; are available to OEMs and usually discounted in volume buys; and are part of a family that has at least one product in the $2,000-$25,000 price range and comes with at least 4K RAM. Size classes are: (S) Supermini; (T) Traditional Mini; (M) Micromini.

AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1978 INSTALLATION
Advanced Information Design	System 3000	Interdata X/16		24	39	3/75	36	0	36	46
	System 4000	Interdata X/32		49		/78	NA	NA	NA	NA
American Management Systems, Inc.	AMS OE/IC	Nova-3		14		1/76	4	0	4	NA
	GFS-11	PDP-11/34		75	100	8/76	2	0	2	18
Anderson-Jacobson, Inc.	1400	AJ 1400	a	16	22	1/70	260	15	275	X
	1500	AJ 1500		20	25	7/77	40	0	40	NA
Applied Data Communications	Event	Event		13	20	2/77	47	3	50	350
Applied Data Processing, Inc.	Resource/100	Nova 3/12		39	88	6/76	10	0	10	15
Ball Computer Products	DASL	Nova-2/10		38	40	6/75	3	0	3	X
Basic/Four Corp.	200	BFC 1340		29	29	2/78	0	0	0	1,000
	350	BFC 1300, Microdata	b	34	34	9/71	500	576	1,076	X
	400	BFC 1300, Microdata	b	37	45	9/71	1,400	1,268	2,668	800
	500	BFC 1300, Microdata	b	39	50	7/72	100	82	182	X
	600	BFC 1300, Microdata	b	51	65	3/75	300	308	608	X
	610	BFC 1320		51	68	1/78	0	0	0	350
	700	BFC 1320		115	130	/77	50	38	88	160
Basic Timesharing, Inc.	4000/15	BTI 4020		36	40	1/76	216	4	220	200
	4000/25	BTI 4020		56	65	1/76	317	8	325	300
Bicaroe Corp.	System 2	Bicaroe		16		/78	0	0	0	NA
Binary Data Systems	UCOM-1	Nova-3		40	60	11/75	48	0	48	25
	UCOM-2	Dual Nova-3		95	120	1/76	20	0	20	6
	UCOM-3	Eclipse		120	170	6/76	4	0	4	10
	UCOM-4	Dual Nova-3/D		200	285	5/77	16	0	16	30
Burroughs Corp.	B80	B80		20	35	11/76	850	950	1,800	2,000
	B700	B700		20	67	3/73	2,400	1,650	4,050	1,500
	B800	B800		32	52	5/77	300	170	470	
Business Controls Corporation	System 80	PDP-8/a		25	40	6/71	100	0	100	30
	System 80	PDP-11/34/45/60/70		45	75	6/75	25	0	25	15
Business Systems Products, Inc.	Adviser II	Computer Auto.		35	45	7/76	30	0	30	NA
	Adviser III	Computer Auto.		65	85	9/76				NA
Cascade Data, Inc.	80/20, 30, 40	Concept		28	43	1/70	50	0	50	X
	Concept II	Concept		25	45	6/75	200	15	215	30
	Concept III	Concept		27	47	1/78	0	0	0	10
	Concept IV	Concept		18	23	4/78	0	0	0	10
Century Computer Corp.	C-400	C-200, 400		34	45	3/75	150	30	180	NA
	C-700	C-200, 400		38	55	6/76	40	10	50	NA
	C-900	C-400		27	40	4/77	100	20	120	NA
	C-1000	C-400		40	50	6/77	15	0	15	NA
	Opus III	C-200		15	22	2/71	560	40	600	X
Cincinnati Milacron	George-40	CIP/2200B		16	20	2/77				
	George-60	CIP/2200B		26	34	/76				
	George-70	CIP/2200B		26	35	/76	545	120	665	350
	George-80	CIP/4400		43	60	12/76				
	Other	CIP/2200B		23	34	/74				
Clary Data Systems*	404	Clary		6	30	1/70	100	32	132	X
Complete Computer Systems	II-3	Nova-3/12		28	42	10/76	18	0	18	
	III-3	Nova-3/12		42	63	10/76	10	0	10	20
	IV-3	Eclipse-S/130		55	80	10/76	7	0	7	
Compucorp	402	Compucorp 3000		13	15	1/76	15	455	470	X
	450	Compucorp 3000		20	22	4/76	40	115	155	NA
	625	Z80		7	10	9/77	50	150	200	NA
Compudata Systems	Series/1	IBM Series 1		26		10/77	2	0	2	100
Computer Hardware, Inc.	2120	CHI		15	50	5/75	10	0	10	X
	2130C	CHI		32	75	7/74	150	5	155	20
	2130D	CHI		44	120	1/78	0	0	0	10
	3230	CHI		15	50	6/76	5	0	5	15
	4210	CHI		10	12	9/77	2	0	2	30
Computer Horizons Corp.	CHI Distribution System	PDP-11/34, 70		30	200	10/76	9	0	9	8
Computer Interactions, Inc.	Compo II-8	PDP-8/e, f, m		45	60	11/72	163	0	163	40
	Compo II-11	PDP-11		50	60	6/75	97	0	97	20
Data General	CS/40	Nova-3/12		33	40	10/77	25	0	25	NA
	DCC 1500	DCC-416	c	16		/76	15	0	15	X
	DCC 2500	DCC-Mod 5	c	29		/76	25	0	25	X
	DCC 3700	DCC-616	c	40		/76	10	0	10	X
	Design Data N312	Nova-3/12	d	31	75	8/75	120	10	130	X
	Design Data EC300	Eclipse C/300	d	60	150	3/76	50	10	60	X
Decision Data Computer Corp.	System/4	System/4		23	37	8/76	15	0	15	125
Diablo	3200	8080	e	19	23	1/77	180	170	350	600
Digital Equipment Corp.	Datasystem 300	PDP-8, PDP-11		14	28	/72	3,600	1,500	5,100	2,500
	Datasystem 500	PDP-11		58	110	/72	650	400	1,050	500
Digital Systems Corp.	Galaxy/5-130	Galaxy/5		33	50	1/76	8	0	8	16
	Galaxy/5-140	Galaxy/5		61	80	8/76	8	0	8	8
	Galaxy/5-150	Galaxy/5		100	130	12/76	2	0	2	4
	Galaxy/5-160	Galaxy/5		150	180	8/77	2	0	2	2
	Galaxy/5-170	Galaxy/5		230	280	9/77	2	0	2	2
Dimis, Inc.	Total 100	Modcomp II		155	180	7/74	12	0	12	18
Display Data Corp.	Insight	Microdata 1600/30		38	62	1/74	300	0	300	500
Educomp Corp. (Quodata)	E-100,200,300,400	PDP-8		7	25	/72				NA
	E-600,700,800,900	PDP-11		44	100	/75	188	9	197	NA
	QDP/78	PDP-8		10	10	/77				NA
	ECS/78	PDP-8		10	11	/77				NA
Financial Computer Corp. (Fedder)	System III/6	System III		19	25	9/77	25	0	25	NA
	System III/8	System III		23	32	9/77	20	0	20	NA
	System III/10	System III		30	45	1/75	400	50	450	NA

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AS OF JANUARY 1, 1978

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1978 INSTALLATION
Gemini Information Systems	Gispac/16	Interdata X/16		48	65	4/76	20	0	20	10
	Gispac/32	Interdata X/32		86	110	4/76	11	0	11	5
	Gispac/1	Series/1		48		/78	0	0	0	20
General Automation, Inc.	DM-130/2	SPC-16/45		28	28	12/74	125	225	350	25
	DM-130	SPC-16/45		30	38	12/74	70	60	130	10
	DM-140	SPC-16/65		48	80	1/75	10	18	28	X
General Information Systems	GIS-350 ABLE	PDP-11/34		42	47	1/76	8	0	8	12
General Robotics Corp.	11/X3	LSI-11		5	7	7/76	75	30	105	50
	FD/X3	LSI-11		15	22	7/76	100	50	150	300
	CD/X3	LSI-11		25	39	9/77	20	10	30	100
GRI Computer Corp.	System 99	GRI 99/50		30	35	11/74	140	50	190	NA
	System 99/E	GRI 99/52		43	50	11/77	5	3	8	NA
IBM Corp.	System/32			33	42	3/75	14,800	5,500	20,300	10,000
	System/34			35	50	12/77	10	0	10	2,000
International Computing Company*	System 95/99	Nova-2/10		24	35	10/72	9	0	9	X
Lockheed Electronics Co., Inc.	System III	Lockheed SUE		30	50	1/73	340	60	400	NA
Logical Machines Corp.	ADAM	ADAM		35	38	4/75	240	120	360	480
Martin Wolfe Inc.*	Mesa Two 7000	DCC-116		54	81	12/71	140	0	140	X
	Mesa Two 4000	DCC-116		62	93	2/76	3	0	3	X
Microdata	Reality	Microdata 1600		32	60	12/73	1,170	200	1,370	800
	Express	Microdata Express		39	50	11/76	10	0	10	NA
Mini-Computer Systems, Inc.	Micos	Nova-3/12		50	69	/73	590	220	810	230
	Micos II	Nova-3/4		29	31	8/77	10	30	40	90
Minuteman Computer Corp.	1774	Nova-2/4		35	40	11/71	35	0	35	NA
	1775	Nova-2/10		37	44	3/72	15	0	15	NA
	1776	Nova-2/10		40	59	3/72	21	0	21	NA
	1776/A	Nova-3/12		40	65	5/77	5	0	5	NA
Mylee Digital Sciences, Inc.	3000 Series	Mylee 3G		25	45	5/76	75	0	75	40
NCR Corp.	8130	NCR		20	24	3/78	0	0	0	300
	8150	NCR		29	38	12/77	5	0	5	300
	8200	NCR		33	66	9/75	800	1,050	1,850	X
	8230	NCR		29	53	6/77	100	0	100	200
	8250	NCR		42	60	12/76	250	950	1,200	1,500
Norfield Datasystems, Inc.*	Nova-system	Nova		35	50	6/73	20	0	20	X
Northrup Data Systems	BDS 500	Microdata 1600		30	44	2/78	0	0	0	NA
	BDS 700	Microdata 1600		39	50	3/77	5	0	5	NA
	BDS 1000	Microdata 1600		50	75	6/72	55	0	55	NA
	BDS 2000	Microdata 1600		63	100	10/73	65	0	65	NA
Pick & Associates	Pick System	7764		64	72	11/73	12	4	16	100
	Pick System	7781		81	90	10/77	3	0	3	50
Programmed Control Corp.	Prophet 21/1	TI 960-B		42	75	/72	30	0	30	NA
	Prophet 21/2	TI 990/10		57	100	1/78	0	0	0	NA
Q1 Corporation	LMC	Q1		21		2/74	500	0	500	250
	LITE	Q1		21		2/77	250	0	250	750
Qantel	800/900	Q7		28	29	5/75	93	71	164	X
	950	Q7		32	36	11/75	382	102	484	NA
	960	Q7.5		48	56	11/76	15	5	20	X
	1200	Q7		42	59	11/75	213	23	236	X
	1300	Q7.5		42	59	11/75	44	18	62	X
	1400	Q7.5		44	60	5/77	134	21	155	NA
Randal Data Systems	Link-100	Randal		13	23	10/75	185	0	185	40
	Link-140	Randal		13		/78	0	0	0	120
	Link-200	Randal		27	35	10/76	132	0	132	160
	Link-300	Nova-2/10		34	45	6/74	) 27	) 0	) 27	X
	Link-400	Nova-2/10		36	45	6/74	)	)	)	X
	Link-500	Randal		46	50	10/77	20	0	20	80
A.O. Smith	Mesa Two	Nova-3		58	58	5/77	8	0	8	NA
Span Management Systems	TSS-2	IBM Series/1		31	31	/77	10	3	13	900
Sperry-Univac	BC-7	Univac		28	45	4/77	395	5	400	800
STC Systems	Ultimacc-2000	Nova-1200		51	85	9/72	90	2	92	10
	Ultimacc-3010	Nova-3/D		55	112	1/75	75	2	77	20
	Ultimacc-3080	Nova-3/D		84	143	11/75	7	0	7	10
Tri-Star, Inc.	TTK-10	Nova-3/12		45	55	2/76	12	0	12	NA
	TEK-80	Nova-3/12		52	67	4/76	4	0	4	NA
Vanguard Computer Systems, Inc.	V500	Raytheon RDS 500		65	85	3/76	5	2	7	20
	V400	Raytheon RDS 500		45	52	6/77	1	0	1	10
Wang Laboratories, Inc.	2200	2200		10	20	4/73	9,900	4,280	14,180	3,000
	2200 VP	2200 VP		15	20	9/76	) 750	) 320	) 1,070	1,100
	2200 MVP	2200 MVP		18	28	12/77	)	)	)	150
	2200 VS	2200 VS		47	80	10/77	15	5	20	100
Warrex Computer Corp.	Centurion I-A	CC-201		18	19	/77	51	0	51	60
	Centurion II-A	CC-202		27	30	/75	76	0	76	70
	Centurion III	CC-203		36	36	/74	324	0	324	200
	Centurion IV	CC-204		43	43	/75	53	0	53	60
Wintex Computer Corp.	200 NS	Wintex		12		1/75	NA	NA	NA	NA
TOTAL							48,246	21,652	69,898	

Notes:
a) Includes installations of Eldorado 140.
b) Basic/Four Corporation computer models used Microdata processors until November, 1976.
c) Digital Computer Controls was acquired by Data General in early 1977.
d) Design Data was acquired by Data General in February, 1977.
e) Marketed in the United States by Shasta General Systems.
*) Not currently active in manufacturing or marketing small business computer systems.
NA) Data is not available.
X) Indicates SBC models not in new production.

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• AS SPRING ARRIVED . . . NEW COMPANIES AND NEW PRODUCTS BURST OUT ALL OVER. With a familiar name but a new product line, Royden C. Sanders Jr. formed R.C. Sanders Technology Systems, Inc., Derry, N.H. The product is a matrix printer that can reproduce images and signatures. At low speed, the Media 12/7's type quality reportedly can top that of electric typewriters; top speed is 216 cps.

A group from Magnetic Peripherals, Inc. has founded Magnex Corp. specializing in thin film magnetic recording heads for disk and tape drives. With backing from Exxon, the group expects to have prototypes by first quarter, 1979. Magnex intends to produce heads that handle storage densities of more than 100M bits/sq. in. Now, ferrite technology is unlikely to support more than 10M bpsi says Dr. Fred S. Lee, president. So Magnex will use a magneto-resistive read element and an inductive write element.

Functional Automation, Nashua, N.H., introduced a 64-bit processor, the F6400, designed to manipulate, store, and retrieve large volumes of data from main memory. The company's philosophy is to provide large memory so users don't have to be software whizzes to make efficient use of the system. The memory is associated with I/O units; at present, a memory I/O (MI/O) comes with 256K, but that is expected to grow to 2M bytes by the late 1980s as semiconductor densities increase. Prices start at $110,000 for the host CPU, two MI/Os, a 65M-byte disk with another 256K-M/IO linked, and a color terminal. Software consists of PL 1/G and the library will be expanded. By hanging several MI/Os onto the system, there could be 24Mbytes total, a spokesman says. With main memory rather than disks, the I/O rate can be considerably faster than on other disk based systems, he says. Ultimately, circa 1984, Functional hopes to provide machines that can be useful to non-computer people. The founder and president, Richard E. Moreley, has started other ventures, as has at least one of his staff. Moreley was in on the ground floor of Termiflex, of which he was a designer, and he started Modicon as well. Funding comes from a group of venture capitalists and unspecified international firms and banks.

And then there is Two Pi and its 32-bit mini version of a 370/138. Two Pi, with backing from U.S. Philips Corp., has signed up NCSS as an OEM account (EDP/IR,Apr.21,1978).

• FROM THOSE NOT-SO-NEW COMPANIES COME SOME NEW SYSTEMS. Sperry Univac topped off its 90 series with the 90/80-4, the only Series 90 with cache memory -- and nearly 32K at that. Main memory is 8M bytes, double that of the 90/80-3, which can be field upgraded to a -4. The -4's processing power exceeds that of the IBM 3031, Univac claims. A 2M-byte system with console, five channels, and cache is $1.26 million; memory is $319,300 for 2Mbytes.

Electronic Associates, Inc., added Hyshare, an EAI 3200 digital computer and up to six analog processors, to its line of hybrid systems. The unit can function as a digital, analog, and hybrid system at the same time.

Digital Scientific Corp. has begun a new line, the Meta 4/5000 Series, intended to cover the range from the upper end of the OEM market to the mid-370 territory that requires high timesharing throughput. The 5020 has twice the thruput of the 4/4000; typical system cost is $73,600.

Harris Computer Systems added the S123 entry level system to its S100 line, with prices starting at $120,000 for 144Kbytes of main memory, 40Mbyte disk, tape drive, 300 lpm printer, and communications capabilities. The S123 expands to 384Kbytes and uses the Vulcan operating system.

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• BURROUGHS LET GO WITH A ONE, TWO, THREE PUNCH recently, adding systems from small to large in the B2800, 3800, 4800, and 6800 series as well as a bunch of transaction peripherals and controllers. At the high systems end, the four new 6800s use 16K chips in both main and Global memory. With new micrologic in the CPU and the faster memory, Burroughs claims performance improvements ranging up to 40% over earlier B6800s and plans to produce more than twice as many 6800s in 1978 as in 1977. The new models can be configured with up to four CPUs and four I/O processors. Prices range from $425,000 to $1.4 million. At the same time, prices were slashed about 18% on older B6800s while lease rates were increased slightly. For those into data communications, the B6360 data communications subsystem for the new 6800s, with 24K and eight communications lines, costs $50,000. For the medium system users, there are five models that integrate the Data Link processors and I/O controls into the central system, thus improving the efficiency of the CPU. The new systems are object code compatible with the previous ones and also have a bundle of new systems software, such as RPG, as well as on-line entry and message control systems. More memory is available on some of the systems. Prices start at $100,000 for an entry level B2805 and range to $390,000 for the B4885, which starts with 500,000 bytes.

Just to make sure that its large base in the banking community stays content, it unveiled "modular transaction control systems" that can also find uses in hospitals, school systems, warehouses, wherever . . . giving NCR fair warning. Among the goodies are two printers, AP 100 and AP 300, TD 500 input and display systems, and DC 128/129 systems and communications processors. The AP 300 can print in various sizes and styles and sells for $1,700. The AP 100, at $5,150, features forms handling capabilities of the TU 1800 teller terminals. The DC 128/129 are independent processors that function as local control centers for the new gear as well as other terminals and displays in a local net. Prices start at $5,150. The TD 500 is a series of mix and match items such as 5- and 9-in. CRTs, keyboards, personal identification number keyboard, and mag card reader.

• LOTS OF TALK ON THE STANDARDS FRONT is expected as Ansi X3 forms three new committees, investigates forming a fourth. X3H1-OSCRL will work on a standard operating system command and response language in coordination with IFIP WG 2.7 on operating system interfaces. X3J6 is responsible for computer language for processing of text; chairman is Charles D. Card of Univac. The language is intended to be used to express the manipulation of text rather than as a hardware language. X3H2-DDL will work on a data description language for data base management systems; John Knutson of Univac, heading this effort, is looking for participants. A group known as X3/SPARC/MICRO will study the feasibility of standards on microprocessors; directing this effort is Donald Feinberg of DEC.

• FOREIGN DISTRIBUTORS SEEM HUNGRY for products. Facit Data Products will sell and service Dataroyal, Inc.'s IPS-7000(R) series of intelligent printers in Europe. Diablo Systems has signed on Geveke Elektronik, a subsidiary of SHV, a Dutch trading company, to market its Model 3200 small business computer in Europe. This five-year contract calls for delivery of 3,600 units with an if-sold value of $80 million. None other than ITT will become a European distributor of Apple Computer Corp.'s personal computers. Apple and ITT have drafted an agreement that gives ITT exclusive European manufacturing rights, nonexclusive marketing rights. In addition, the two companies will have a mutual cross-licensing agreement to exchange applications software, and ITT will buy a sizeable quantity from Apple until it activates manufacturing facilities.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MAY 28, 1978 • VOL.13,NO.23 P.J.McGOVERN,PUBLISHER

AS MORE IBM-COMPATIBLE PROCESSORS CROWD MARKETPLACE PICTURE, IBM MAY BE PROMPTED TO ANNOUNCE "E" SERIES WITHIN MONTHS

With the recent addition of three entrants in the computer marketplace, lines are becoming increasingly hazy between superminis and mainframes, specifically, IBM plug compatible systems. Recently Two Pi and National Semiconductor unveiled "superminis" that also happen to accept IBM operating software. Shortly thereafter Magnuson Systems, Inc. joined the ranks of the IBM plug compatible mainframe manufacturers (PCMM) with its M80s. There are a couple of different ways to classify the players: by marketing approach and by capability.

- The Two Pi and National Semi machines currently are categorized by IDC as superminis because they are being marketed by their makers on an OEM basis. Magnuson, however, is in the IBM plug compatible race along with Amdahl, CDC, and Itel; it is marketing to the end user.

- Two Pi, National Semi and Magnuson are or will be factors in the IBM PCMM market because they can run IBM software. Granted, the superminis from Two Pi and National Semi are more likely to wend their way into installations as distributed nodes or as an additional CPU rather than as a replacement per se, but by virtue of software compatibiity they are PCMMs.

The picture is sure to become more hazy as the action becomes more frenetic. Currently the three recent entrants in the 138, 148 arena also are the manfacturers. But the number of vendors is sure to grow when Two Pi and National Semi put into full swing their OEM marketing campaigns, and Magnuson expects to ship 20% of its business to OEMs. They all are targeting the same type of customer -- plug compatible peripherals suppliers and services firms (Two Pi has signed up NCSS). This proliferation of suppliers is likely to lead to some changes on the pricing front. The supermini sector is almost certain to feel the tremblings. The scene will, in all probability, resemble that of the plug compatible peripherals market in the early 70s, with many vendors offering similar products.

EDP/IR sees the recent entrances as a cue to IBM to bring out or at least announce its E Series sooner than later in order to take some of the wind out of competitive sails and keep users in the IBM fold. IBM has learned from the early 70s that providing product window dressing -- a la the 2319A and B -- can lead to lengthy court battles. EDP/IR thinks this time around the

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giant will elect to introduce a new system rather than lure users via firmware that simply handles a new disk.

EDP/IR sees these machines, be they minis or mainframes, as a potentially significant factor in enlarging the installed base of systems using IBM software. They will likely abscond with a portion of the market being created and eyed by the superminis -- primarily in distributed data processing. But also they will help that market's growth. In effect, users can keep their IBM programs, or create ones that are compatible with the central IBM site, and have a distributed net, all for the price in the ballpark of the superminis.

Over 11,000 superminis are expected to be shipped in 1978. But the supermini is not the only market likely to be impacted by these machines. The upgrading of 135s and 145s is proceeding apace. At yearend 1977 IDC estimated there were 4,170 installed 138s and 148s worldwide and 7,630 installed 135s and 145s, indicating the upgrade market is sizeable. Too soon to predict the newcomers' impact here.

But with more vendors in the 138, 148 arena, there could be increasing concern about viability of the marketers as price erosion looms as a likely event. In that case, users might decide to pay the price and stay with IBM. Time will tell.

The chip is the system

The overriding message of the National Semi, Two Pi and Magnuson announcements is that microprocessors are here to stay and their use is impacting the architecture and performance capabilities of machines in the high end as well as the low end. National Semi's announcement takes the concept of vertical integration to its logical conclusion and gives that firm an inherent advantage in price margins versus the others who are buying their components.

Emphasizing the evolution of the computer to the chip level, Pierre Lamond, National's vice-president and director of technology development, said: "The chip is the system and system is the chip."

National is evolving away from the role of the components supplier to that of a "systems technology" company as it acquires systems design capability in its role as a chip developer. LSI devices, he explained, require a "much closer working relationship between the component manufacturer and the computer maker to use this capability to manufacture computer systems."

By 1985, Lamond predicted, it will be possible to put the equivalent of an IBM 370/158 on a single chip. Bit density has increased from 1K bit on a chip in 1972 to about 16K to 64K or more today, and densities by 1980 should be in the 128K to 256K range, reaching 1Mbits on a single silicon chip by 1985, Lamond said.

The National System/400 is a 32 bit minicomputer with bus architecture and multiple processors handling specific tasks: instruction; I/O; and service (supports diskettes, diagnostics, and console). Memory is also attached to the bus, which transfers up to 20M byte/sec via a time-sliced synchronous technique.

The individual processors contain writable control store; the system is described as totally soft, allowing for future changes to be inserted via the diskette that stores microprograms for all processors in the system. Memory is available in 256K increments and each module can be operated separately.

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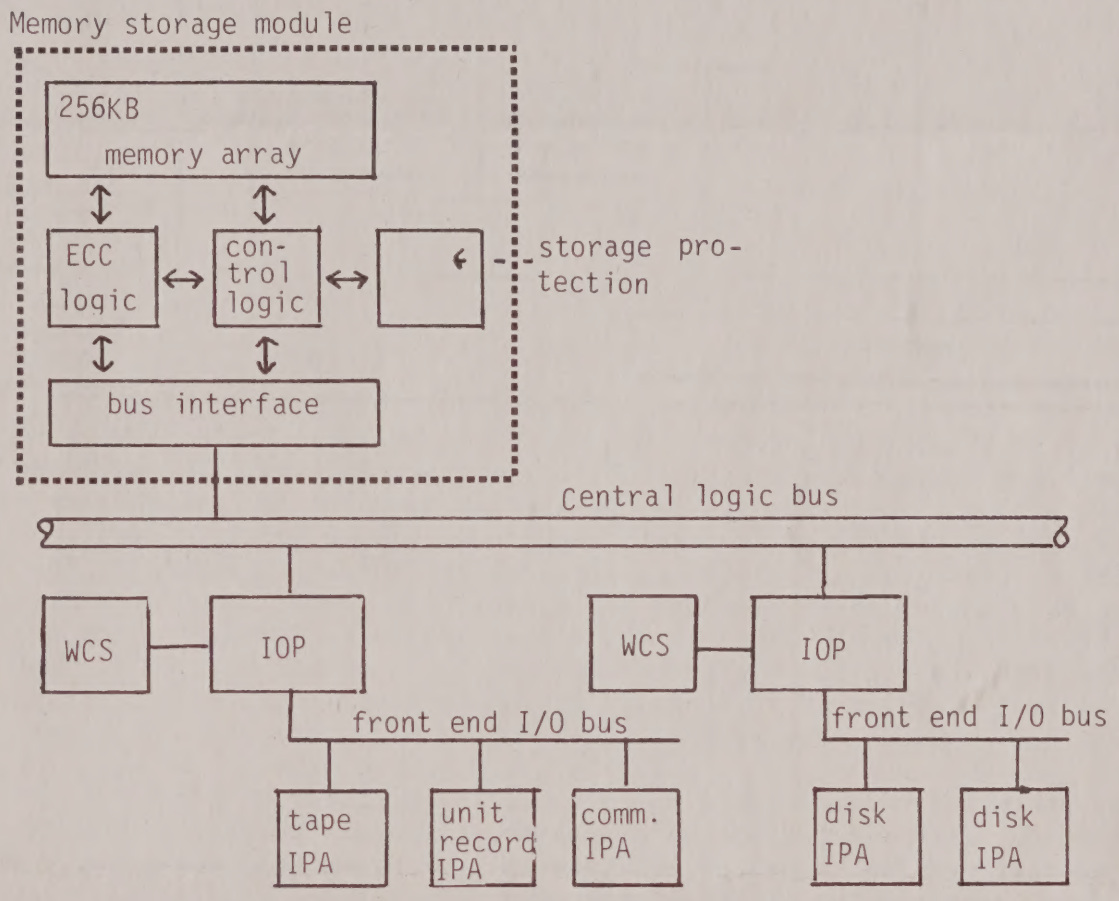
National says the System/400 executes instructions about 1.5 times faster than a 138 but that its I/O system does not degrade the instruction execution speeds as do 138 channels and I/O adapters. A typical system provides throughput similar to that of a 145, National said.

From a minimum of 256K, the 400 can be expanded to 16M bytes and 12 I/O processors. The price of a minimum system, with two I/O processors, 256K bytes 200 Mbyte disk and adapter, tape drive and eight communications lines and adapter is $165,000.

NATIONAL SEMI'S SYSTEM/400



Magnuson offers upgradeable family

Magnuson Systems unveiled its first two entrants in a family of machines that will eventually range from the 115 through the 3031 level. The M80/3 and /4 are said to offer 20% to 100% better performance than their IBM counterparts, the 138 and 148, respectively. A /5, which will top the 3031's performance, is planned for introduction this summer.

In addition to IBM compatibility, the systems have the capability to emulate other machines, although that microcode is only in the development stage. Through

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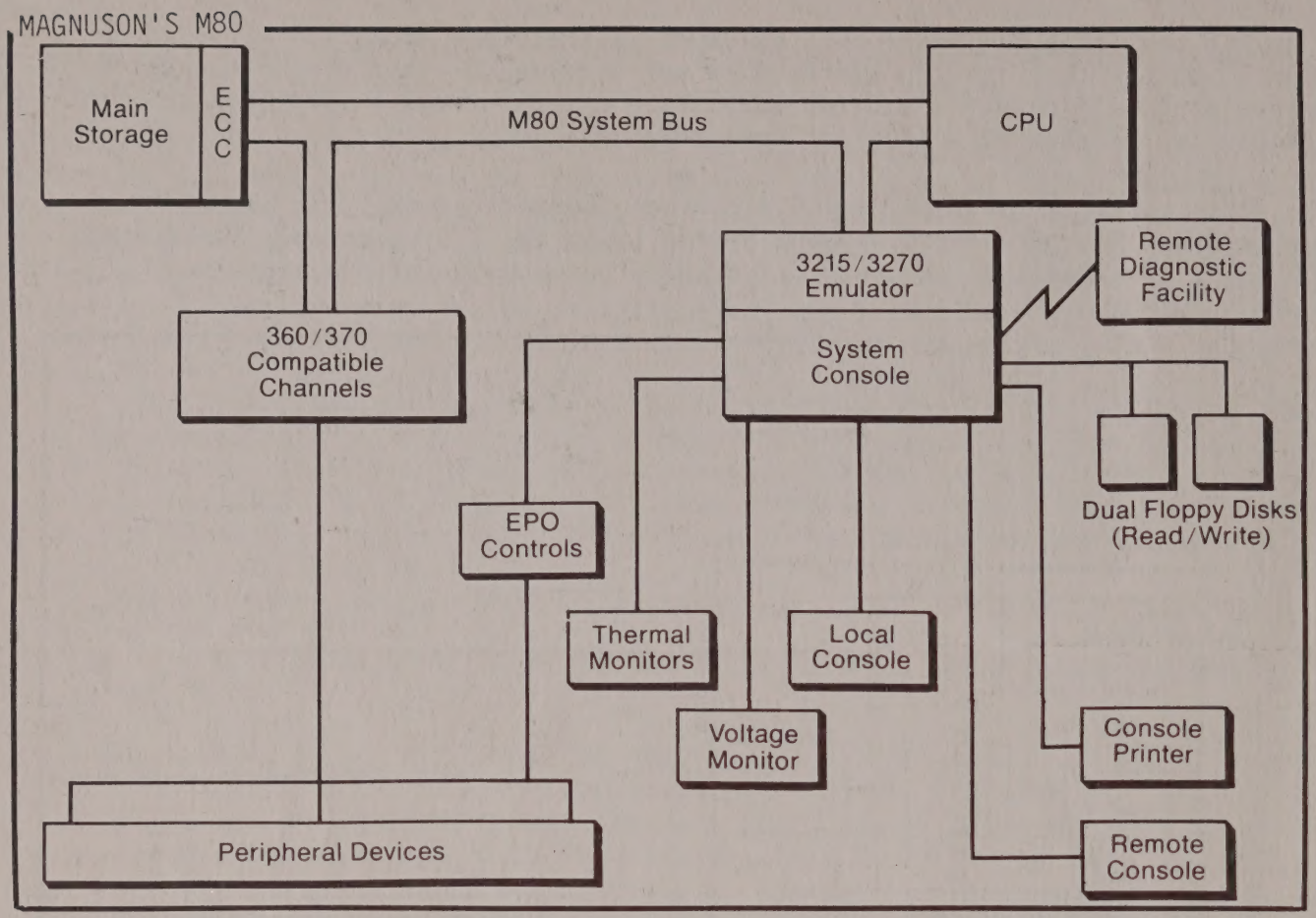

the use of Strategic Architecture, the M80/3 and /4 are structurally as well as functionally modular, providing flexibility and reliability. The machines are upgradeable through the substitution of circuit boards. The reliability can be enhanced through the use of "failsafe hardware" such as multiple identical boards. In addition, there is very little cabling, which is often a source of unreliability, the company said. Because the location of boards is not restricted by wiring, the system can be flexible and allow fine tuning through the addition of boards for floating point or other features. In addition, 256K of writeable control store, of which 8K is occupied by IBM compatibility, offers further opportunity for enhancing the system.

The systems can accommodate up to 4 billion bytes of main memory, when and if that amount is permitted by IBM's systems software. Currently, the systems have a capacity of 16M bytes and 16 channels. Designer Carl Amdahl, son of Gene Amdahl, observed the systems' design has eliminated "artificial restrictions" for channels and memory. The channels, which may act as either byte, block or selector, are equivalent in speed to those of the 158.

Although Magnuson has several former Amdahlers, its components approach is quite different; Magnuson uses only off the shelf components. Ray Williams vice-president, finance, was a co-founder of Amdahl and Paul H. Magnuson, president, also was at Amdahl at one time. Carl Amdahl has had experience at Advanced Memory Systems, Fujitsu Ltd., and also participated in the final development of a POS system produced for McDonalds restaurants. Robert McCullough, vice-president of operations, developed a 168 add-on memory at National Semiconductor. Kevin Anderson, vice-president of software, developed the OS/VSAM for Itel.

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	Two Pi	National Semi	Magnuson
vs. IBM	138	138	138, 148
Performance Improvement	=138	1.5x 138 instruction execution	1.2 to 2 x
Price 138 148	(NCSS=$160,000 for 512K)	$165,000, 256K, 200M disk, tape drive, 8 lines	$200,000, 512K 3 channels $395,000, 1M, 5 channels
Technology	TTL bit/slice	TTL bit/slice	TTL
Architecture	Bus	Bus	Bus
Multiple processors	NA	Yes	Yes
Max. memory	4M	16M	16M
Max. channels	8	12	16
Byte, block, selector	Yes	Yes	Yes
Firmware capacity	160K bytes	3.4M bytes	256K bytes
Multiprocessing	under development	yes	yes
Current Operating software	DOS/VS VM	DOS/VS, VM	OS, VM, MVS DOS-VS, VS1
Future Operating software	DOS, OS/MFT, OS/VS1		extension features
Shipment date	June	1 qtr, 1979	June
Delivery	60-90 days		60 days
Accept Mini peripherals	future	now	
Marketing	OEM	OEM	OEM, end user

The company was formed in 1977; Fairchild is acquiring a one-third financial interest. Magnuson is discussing a cross license with IBM that pertains to patents.

An interesting feature of the Magnuson system is its console, whose capabilities are said to exceed that of the 158 unit. A microprocessor provides monitoring of temperature and voltage. In addition, there is capability for emergency power off and remote diagnostics. Using a diagnostic language of the firm's own invention, the system can spot trouble down to the chip level.

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Unlike Two Pi and National, Magnuson is marketing the systems to the end user and is setting up sales and service facilities in eight cities; five are already signed on: New York, Washington, Atlanta, Dallas, Chicago. Vice-President of Marketing Joe Hitt expects to ship 80 systems between June and the end of the year, and hopes the mix will be 80% end user (including leasing firms) and 20% OEM. The backlog of orders is "significant," he said, and the company is finalizing arrangements with a large (U.S.) firm to handle sales abroad.

DG GIVES ITEL, OTHERS, FAMILY OF SMALL BUSINESS COMPUTERS

Add Itel to the list of services firms selling computers. But also add Itel to the almost nonexistent list of large, nationwide firms aggressively attacking the small business computer market, heretofore the province of small, local firms. Itel's Business Systems Division, a unit of the Data Services Group, plans to be a single source of hardware, software, maintenance and financing (full payout leases). But Itel's plans are on a large scale, involving not only its services operations in 57 cities but also a separate sales force that will grow from 45 marketing reps to about 90 in a year or year and a half.

With the recent acquisition of Delta Resources, a software house providing turnkey solutions, Itel has beefed up its ability to provide packages; in addition, it expects to sell programs written by other systems houses.

Itel is targeting sources of multiple orders such as trade associations and Fortune 1000 companies -- it already has significant contacts with Fortune 1000s through its leasing business. Itel is aiming at companies with revenues between $500,000 and $25 million, focusing on various vertical marketplaces such as the distribution, accounting, garment, auto, transportation and medical industries. The Itel approach has its own wrinkles apart from those of National CSS, ADP and Keydata (EDP/IR, April 21).

- Itel stresses the DG origin of the entire system, including peripherals and service. Keydata hangs CDC peripherals on a DG mini and uses CDC service.

- Itel seems to be aiming at a broader market segment than Keydata, which relies on its expertise in the distribution industry for the development of packaged systems.

- Both Itel and Keydata will be adding to their marketing forces and looking for nonservices customers, but the Itel effort is much larger. ADP's On-site is part of its service; NCSS is letting non-customers come to it.

- Whereas NCSS and ADP offer a smooth link between their hardware and network (use the same operating systems), the link between Itel minis and its service outlets is hazy at best. Itel will be touting the capability to use services off line for remote printing and sophisticated jobs. Keydata's units are stand-alone, although the company plans to introduce distributed processing systems eventually.

Quite likely the Itel courtship with the small business market could cause others to take a second look. Previously, handholding, considered an essential part of the small business market, has frequently deterred or at

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DATA GENERAL ADDS, MAKES 'FAMILY' OF COMMERCIAL SYSTEMS

A year after the introduction of the CS/40, a Nova-based system, Data General added to the low and high end, trumpeting its range of commercial systems that offer Ansi '77 Cobol Level 1 and interchangeable programs. The systems are suited for interactive use and program development.

Probably the sexiest item at the unveiling was the CS/20, a micronova-based unit with up to four floppy disks, that starts at $10,945. The 20 is organized so that I/O looks like positions in memory. The Cobol compiler occupies 8K of the 64K memory. Communications are handled by RJE 80, DG's answer to 2780, 3780 emulation. The 20 compiles at 120 line/min and can handle up to a 2000 statement program. The system is suitable for a stand alone business system, dedicated or distributed processing with only occasional updating of files or as a very intelligent data entry terminal. DG emphasized ease of use; even the screen formating is done in Cobol.

The CS 40 got some bells and whistles, such as Hasp II, alternate (four) key access to Isam, and job concurrency, as well as a 50M byte disk and faster printers -- 18 char./sec or 240 line/min.

The CS 60 is a repackaged Eclipse 130 available in three models from 64K and four terminals to 256K and 12 terminals. The 60 features both Hasp in addition to 2780, 3780 communications. Its strong point is its ability to handle multi-task interactive transaction processing. A system with 256K, tape drive, 380M bytes disk, eight terminals, two printers and communications sells for $151,920.

least deferred large companies from a commitment in this area. If Itel can make a splash with 98% of its business being packaged systems, as is its plan, others surely will investigate the market more closely.

Small business market: large and growing

By offering such a low end system, Data General plans to broaden the small business market. Currently, three quarters of the market lies in companies with revenues from $500,000 to $25 million, and one quarter in larger companies needing remote dedicated or distributed processors, DG said. But with the CS/20, the market includes 1.75 million very small companies in the range of $100,000 to $500,000 who spend and/or lose $450/mo on accounting processes. DG's "fully integrated applications oriented business systems packages" are suitable for cpas, dentists, realtors, department stores, and insurance agencies as well as distributed systems, DG said.

The market is large in terms of units and growing rapidly. IDC estimates there were 21,350 small business systems shipped in 1977 in the U.S., for a total installed yearend base of 48,250 units. By 1982, shipment values will more than triple from $800 million in 1977 to $2.6 billion in 1982. Shipments should reach 65,800 with the base totaling 250,000 units in 1982.

Although DG is adding to its end user marketing force, its principal thrust with this series is to the systems house and services firms.

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• HONEYWELL AND DATA GENERAL SEEM TO BE HAVING A CONTEST regarding who can put Cobol on the widest range of small systems. Gone are the days when Cobol was non-existent on minis. Honeywell last week capped the top and bottom ends of its Level 6 line with models 23 and 57 and also added an intelligent terminal to its line of VIP systems. The smallest Level 6, the 23, is not field-upgradeable to the rest of the line but is software compatible and runs Cobol, Fortran and the other languages available on the other 6s. The (double sided) diskette-based, communications oriented system begins at under $14,000 for 32K words. Maximum is 64K. The 57 handles Cobol twice as fast as the Model 47, has its own version of a separate Cobol processor, 4K words of cache -- a new feature on the 6 line -- and up to 2M words main memory. Prices start at $127,000. A typical 57 with 192K words, 4K cache, 512M bytes disk, tape, printer, card reader and 17 communications lines, Mod 600 operating system and Fortran costs $217,000. HIS also added a new operating system, GCOS 6 Mod 200, an entry level transaction processing system. The VIP 7800 line of terminals begins with the 7801, which is based on a Motorola 6800. Not yet user-programmable, the 7801 has off-line editing capabilities including screen formatting and line graphics. A 25th line on the display communicates with the operator. Single unit price is $2,885. Double sided floppies contain 512K bytes and cost from $1,700 to $3,650. Honeywell recently added software to make its 6s look like Hasp workstations or 2780/3780 remote batch units.

• THE U.S. INVESTMENT IN R&D IS DWINDLING as a percent of the gross national product and should be boosted up to its previous high of 3%, according to Gerald G. Probst, Sperry Rand group executive vice-president and former Univac president. Stressing the importance of research and development in the growth of the economy, Probst called on government to encourage the private sector to sink more money into R&D. Measured in 1972 constant dollars, R&D investment as a percentage of GNP has dropped below the 3% reached in the mid 60s. Among the steps government could take to encourage industry outlays are: investment tax credit; accelerated depreciation; and elimination of double taxation on corporate dividends, he said.

• MICROS ARE BECOMING USEFUL, FORMIDABLE devices. SDLC on a chip? Yes, from Western Digital. The SD 1933 controller interfaces parallel digital systems to synchronous serial data communications channels employing SDLC line protocol, the company said. The 40-pin chip supports baud rates to 1.5 HMz and can be used with a variety of mainframe, mini and micro data buses. . . . Intel has upgraded its line of single-chip microcomputers with the 11 MHz 8049 and 8039, which provide an 80% improvement in speed over the 6 MHz version of the 8049. . . . Those who want to make their data more secure can use NBS-approved encryption devices from Intel and Rockwell. Intel's 8294 is a single-chip unit; Rockwell's CR-300 circuit card, designed for use in data terminal units, is in addition to its CR-100 network encryptor. Both Rockwell units are based on its own encryption chip. . . . For those developers of Intel 8080- and 8085-based systems, Intel presents Ansi 77 Fortran for use on its Intellec 220 and 230 as well as on the MDS-800 and 888 development systems.

• MAKERS OF CLUSTERED SYSTEMS are expanding, enhancing and repricing their wares. Mohawk Data Sciences added the 21/50 which doubles the processing speed, size of memory and storage of the 21/40. In addition, the new system offers multiprogramming and concurrent task execution, two previously unavailable capabilities. A minimum 64K system sells for about $15K, leases for $477/mo. . . . Inforex dropped prices on its System 5000 to woo smaller users. . . . Sycor added CDC's Remote Job Entry to its 445 distributed system.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JUNE 12, 1978 • VOL.13,NO.24 P.J.McGOVERN,PUBLISHER

Robots cavort amidst crowds -- page 2

NCC PRODUCTS ILLUSTRATE IMPACT OF MICROPROCESSORS BUT NEW TECHNOLOGY SPARSE AMONG PLETHORA OF NEW PRODUCTS

The mammoth 1978 National Computer Conference (NCC) -- by the law of averages -- had something for everyone, and nearly everyone, it seemed, was there.

New products were everywhere, in nearly all areas, defying previous labels of "a terminal show" as in New York, 1976, or "a printer show" at Dallas last year. This was truly a "computer show," with more sizeable systems than at any time since 1969. Indeed, the flamboyance of many of the exhibits, the size of some of the booths, and the acreage consumed by the show's 300+ exhibitors in four exhibit areas prompted many comparisons with the 1969 Fall Joint Computer Conference in Las Vegas.

But few believed the past is prologue to the present, for Vegas was the last gasp of boom times before the crunch of the early '70s.

Although new products abounded, there was little embodying really new technology. More than anything else, the '78 NCC was a statement of the obvious impact of microprocessors on the DP industry. It has never been any secret that the semiconductor industry would drastically change the character of the DP industry, but the NCC showed that micros are a pervasive force in just about every imaginable product area.

True, the semis in products on the floor don't come close to the capabilities being forecast by the semi representatives; but on the other hand, current products do provide a guidepost as to where the 1978 flag is positioned on the steep downward slope of cost reduction being traveled by the DP industry and the semi industry. Whether these two are traveling this path as intimately related partners -- or locked in a deadly embrace -- remains to be seen. Clearly the semi makers are assuming a larger part of systems design responsibilities as they fabricate more capable processor chips. And the next logical step will be to tackle the problem of software costs via firmware.

Another obvious statement of the conference was that DP is fast becoming of interest to the general public. Attendance was 57,240, excluding registrants for the personal computer portion of the show. Dallas drew 36,518. Some trends:

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ROBOTS CAVORT ON CROWDED FLOOR AS NEW PRODUCTS VIE FOR ATTENTION OF WEARY ATTENDEES

The atmosphere of Anaheim's NCC was definitely on the upbeat amidst hoopla and scenery and crowds that hark back to the days of the '69 Vegas extravaganza. And despite the incredible number of attendees devoted enough to endure three hour waiting lines to register, exhibitors were pleased with the caliber of interested buyers. Apparently many of the 57,240 attendees were not simply tire kickers, indicating the upbeat should continue for the foreseeable future.

There were some frustrations -- generated principally by the overwhelming scale. Bewildered attendees sought valiently to sort out the North, South and Arena exhibit areas and to fight their way through the registration lines while en route to sessions. But the West hall was distinctive -- it was a converted parking garage with low ceilings and high temperatures -- 92 degrees was not uncommon. But that merely provided a good test of whether the DEC 2020 needs no air conditioning. DEC's Andy Knowles wasn't worried about the 2020, but he admitted disks don't often like hot weather. The Anaheim area can comfortably accommodate 20,000 for conventions, so getting phone lines, anything to eat within a reasonable amount of time, etc. became major achievements.

The leading crowd attractions were robots -- of which there were three: Datamation, Software AG and Siemens. Datamation's was acknowledged to be the wittiest and made it to nearly every party in town as well as amusing attendees. The robot was even known to pull such stunts at a party as being fresh with women. It was controlled by someone in the ever present crowd of on-lookers. Perkin Elmer stopped traffic with its 1959 white Mouliner Rolls Royce. PE obligingly provided attendees with a mug displaying a picture of the attendee majestically sitting in the car obtained from Beverly Hills.

In general booths were larger than ever, and models were once again evident. Ma Bell showed her sense of humor with Mickey Mouse phones used with her data sets. Some of the exhibits tended away from computers -- Data General had a slide show showing a version of recent U.S. history including scenes from Woodstock. But inside the booth it was all products, ranging from the small CS/20 to the M600 and an array processor. Many of the booths made the most of the tall ceilings, but in the West hall the ceilings were about 11 feet high.

This show had the highest number of sizeable systems since the days of the boom before the bust. Prime Computer proved correct in its preconference publicity and had the largest memory of any system -- 8M bytes. Prime perhaps epitomized the trend toward serious demonstrations -- it had four users demonstrating their applications on a Prime 500. IBM brought a 3031, DEC a 2020, DG its M600, Tandem a four-processor, 1 Mbyte system, and National had its 400, to name a few.

As Ed Sullivan used to say, NCC was "a really big show." At least one exhibitor busily eating his way through one of the many parties asked how long this rate of boom can continue.

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- Mini capability in devices that look like terminals from new players in the dispersed data entry area.

- Communications capabilities for IBM systems.

- Printers filling the gap between 300- and 1,200 line/min.

- Nova compatible minis from such non-mini makers as Ampex, SCI and Lear Siegler.

- Series/1 peripherals, in many cases standard products with a new interface, and 303X memories.

Is it a computer or a terminal?

Nowhere was the impact of the microprocessor more evident than in the entries by mainframes and minimakers into the dispersed data entry field. Although looking like CRTs, the units have the same capabilities as minis. For years mainframers and minimakers have been watching the large and growing market of dispersed data entry/distributed processing in which Sycor, Datapoint, and others romped. The entries by NCR and DEC are probably the first of a new wave of participants. NCR's entry currently communicates only with NCR but should soon include emulation facilities to link with IBM CPUs.

But there was action by others as well. Life would not be complete without a word or two from Ma Bell. This year the word was announced by little brother Teletype in the form of the 43 teleprinter and the 4500, initially being heralded as price competitive with the IBM 3770 line, but actually it harbors a good deal of untapped capabilities that could surface when Ma Bell decides how far to push the issue of what divides communications from computers. ITT Courier, strengthened by an infusion of cash from ITT, is attacking the 3770 arena and Lear Siegler is putting more smarts into its terminals -- even the dumb one has two pages of memory. Computer Devices packed a programmable computer into what looks like its traditional terminal. Among the super capable terminals:

- NCR's 7500s are designed for the non-clustered, data entry environment. Each unit has an 8080, 40 Kbytes and Basic+ 6 as well as bisynch communications up to 9,600 bit/sec. The three models range from the $5,575 unit with a cassette to the $20,000 media conversion unit with a single-sided floppy, cassette and mag tape. Up to 24K is available to the user with Basic+ 6, but only 2K with data entry programs. Four printers from 50 to 125 line/min can be linked to the 7500s. The CRT screens are 9 in. diagonal with 512 characters. The floppy is 3740 compatible.

- DEC's programmable data terminals (PDT) are 11-based systems with from 16K to 60 Kbytes and link to a cluster controller. The systems have the same software instruction set as other PDP 11s, the RT operating system and accept all the same languages. A major difference between the PDT and other 11s is it lacks a bus structure and is therefore not so expandable. The maximum size system includes a $230 cluster controller, four PDTs, a printer and communications. Memory is expandable by replacing boards rather than adding. The operating system takes upwards of 8 Kbytes. Prices of PDTs range from $1,900 for a dumb unit to $6,325 for 16K with a single floppy.

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- HP's 2647A is a graphics terminal that can be programmed in Basic. It has 64K for Basic, 32K for graphics and 56K of ROM for terminal control functions with a price of $8,300. HP was not at NCC.

- Computer Devices' portable computer packs 32K, a micro-controlled Basic interpreter and a mini cassette into what looks like its traditional printer terminal. The unit is programmable in Motorola 6800 assembly language and costs $5,485. An optional acoustic coupler handles communications up to 1,200 bit/sec.

3770 attracts competitors

Teletype led off with the 4500 family's first model, the 4540, which, taken at face value, is meant to be competitive with IBM's 3770 family, including the 3278, 3274 and 3276 controllers. It is designed for applications such as inquiry, response, data entry and retrieval but Teletype will add remote job entry, interactive and batch capabilities. User programmability is certainly a possibility, depending on Ma Bell's perception of the regulatory climate. The 4540 provides clustering capability -- a cluster is needed for more than two displays and can handle six -- whereas the 40/4 does not. But 40/4 screens can be added to the system. The new line is compatible with 3270-type host software. The price of six displays and a controller is $17,000. Clustered versions can handle a maximum of 32 devices, including eight printers. Delivery begins the first half of 1979. The 4540 has two microprocessors -- one handles the CRT located in the tube's circular base, the other controls communications.

The 4540 represents the first in a line of general-purpose terminals that will be applications-oriented to fit user needs. J. Roger Moody, executive vice-president and chief marketing officer at Teletype gave fair warning when he said at a press conference: "It is our intention that this announcement of the 4500 system will clearly signal commitment on the part of the Teletype Corp. to provide a wide range of system solutions to meet user needs in today's sophisticated computer-based communication systems. The 4500 system is evidence of a change from Teletype Corp.'s traditional product orientation to a user application orientation." To be responsive to user needs, the firm is revamping its marketing support along industry lines -- consistent with Bell's marketing thrust.

Teletype also unveiled the 43 teleprinter, which comes with user selectable options and up to 20K buffer. Communications are up to 1,200 bit/sec on dial up and 1,800 bit/sec on private lines. Local text editing and simultaneous line/local operation are other features of the 30 char./sec printer unit that sells for $2,900.

Another vendor in the 3770 field is ITT Courier with its line of local and remote plug-compatible 270 controllers. The units cost around $9,000 and handle up to eight devices; with a device adapter they can support another eight devices. Protocols available include 3272, SNA, bisynch or SNA/SDLC. The 270 terminals, about $2,500, display up to 3,440 characters as do the newer IBM models. Existing units are field upgradeable for $150.

Control Data's answer to IBM's 3770 family is the Certainty 760 series, which is user programmable (courtesy of a Z80) via a forms language or a version of Basic. A minimum system consists of 48K, 512K floppy and the forms language for $8,671; top of the line, also 48K, has 1M floppy, both languages, a 180 cps matrix printer for $12,750. CDC says it competes with Sycor's 405 and Datapoint's 1500.

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Independents add communications to IBM systems

Independents have extended their sights beyond plug compatible peripherals and memory to communications for IBM systems. Entrants include a veteran in the IBM PCM arena, Memorex, and a newcomer, Datapoint.

Datapoint's approach utilizes the channel adapter from its Attached Resource Computer (Arc) system (EDP/IR,Dec.5,1977) that links directly to an IBM 360 or 370 byte multiplexer while looking like unit record gear. The Datapoint scheme, called Datapoint Attached Support Processor (Dasp) lets the user have batch teleprocessing capabilities while keeping his OS software. Dasp controls up to four telephone lines connected with Datapoint processors, spools data to its disks whil transmitting and receiving I/O through the byte mux. The phone lines can be a combination of leased, multipoint or switched access. The standard Dasp includes the channel adapter, a Datapoint 6000, 5 Mbytes of cartridge disk and software for $37,500 or $1,044/mo. EDP/IR views Dasp as an indication Datapoint may extend its Arc concept to embrace full interaction with IBM CPUs.

Memorex' Super 3 package enables a System 3/8, 10 or 12 user to have online capability after performing file definition and screen format design. Sysgen and program conversion are not required. Memorex said its package takes a maximum of 16K memory whereas the IBM CCP needs about 48K. The Super 3 package enables on-line capabilities for file inquiry, update and data entry while batch processing is performed simultaneously at savings of up to 60% of the cost of upgrading to a System 34, the company said. Up to 32 CRTs can be supported in a local mode. Lease price for the package, including local display controller and software, is about $125/mo.

Printer makers stretch lines

Printer makers focused on attempts to grab a piece of the here-to-fore no-man's land between the 300 line/min matrix and the 1,200 line/min line printers.

- Data Printer, known for its chain trains, is courting the lower-speed market with band printers ranging from 75 line/min to 600 line/min; prices in 100 quantity range from $3,075 to $3,600. It also added a higher speed chain train, 1,500 line/min, at $14,500 OEM.

- NEC Information Systems features a series of 300- and 600 line/min band printers ranging from $3,200 to $3,400 for a model that includes graphics capability and 10 and 15 pitch type.

- C. Itoh's 8601 is a 600 line/min chain printer with heavy duty components priced "in the range of Centronics."

- Documation's 1,000 line/min printer with integrated controller sells for about $35,000.

Other printer action included Tally's Hush Tone T2000, a 200 line/min printer that is below 60 dba with a one part form and rolling Ascii. Also available as a 125 line/min unit, it sells for $4,500 end user. The T3000 is 300 line/min with the same print mechanism but with two micros that handle the print mechanism and I/O interface. With its status control device, the company expects to cut in half the number of service calls. The T3000 sells for $7,995. Centronics took it easy this year compared with last, and the only new product was a version of its 700

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series adapted for demand document printing featuring economical forms tearoff. But products weren't the only news; Centronics dropped the price of its micro-printer from $595 to $395.

Nova market draws three entrants

Several non minimakers decided to enter the arena via their versions of Nova compatible CPUs. One of the key thrusts is the ease of maintenance with front panel access. Several of the models are aimed at the high end of the Nova line and some include or plan to include features not found in DG units.

- Ampex is entering the mini business because it makes the memory, disks and tapes and the move seemed to make sense, the company said. The unit features 64K words of core or MOS that is directly addressable. Operating speeds are either 800- or 1,200 nsec and the largest model can include 2 Mbytes of Megastore in addition to the 64K. The Model 12 with 32K words of core in a five-slot chassis costs $3,975 OEM.

- Lear Siegler, using its terminal that is Nova compatible, has officially entered the mini business by putting the guts in a separate cabinet. The VDP 410 with 32K words ranges from $3,500 end user to $2,000 in lots of 500. Compilers for Basic, Cobol or Asgol cost between $750 and $500. A virtual operating system is available.

- SCI, known for its rotary printer, showed its Mercury, which is price competitive in maximum configurations. Currently Blis Cobol and Iris are available and SCI intends to provide an operating system within six to nine months that will provide up to seven partitions compared with DG's two. Maximum memory is 128K but will be extended to 256K.

Independents zero in on Series 1, 303X

Whither IBM goest, the others are sure to follow, especially when IBM leaves an attractive price umbrella, as in the case of add on memory, or a gap in its product line, as in the case of Series 1 peripherals.

In the Series 1 arena, CDC devoted over half its huge booth to a line of existing products that it had decked out with the Series 1 interface. Disks range from a single/double sided floppy drive to 240 Mbytes. The 230/240 series combines fixed sealed modules up to 19.7 Mbytes with or without a floppy. The Storage Module Drive ranges in capacity from 63- 240 Mbytes with the top price of $41,500 for the 126 Mbyte unit. CDC's Series 1 console can be located up to 4,000 feet away from the CPU rather than IBM's limit of 400 feet and sports a price tag of $2,420 vs IBM's $4,979. CDC has printers from 180 char./sec bidirectional for $4,030 to a 440 line/min printer at $15,300.

Documation also joined the Series 1 bandwagon with its card units ranging from its hand fed reader to a 600 card/min unit that communicates at 9,600 bit/sec and sells for about $8,000. Eventually the company expects to develop one interface that can link to both 360s, 370s as well as to the Series 1.

The add on memory arena for the 30 series appears to be attracting more entrants by the minute. Although unofficial quotes range from $68,000/Mbyte to $88,000, nearly all are verbalizing $75,000 in contrast to IBM's standard rate of

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$110,000/Mbyte. However, one vendor viewing heightened demand caused by a perceived unwillingness of IBM to ship more than 3M per system is said to be contemplating raising prices. The current players include National Semi, which recently announced it will sell memory to the end user; Intel; EMM, and Memorex. Other likely entrants are Storage Technology Corp., which is "in negotiations" with suppliers, and CDC. Some of the products use 4K static RAMs and can be used on the 3033, while at least one uses semi static 8K and extends only to the 3032.

But more interesting than the hordes offering memory is the prospect that additional members of this group will become suppliers of plug compatible mainframes. Trude Taylor, board chairman of EMM, hinted that his company might join the ranks -- and maybe with a system of its own manufacture. Ed Farris, head of EMM's Computer Products Division, said if the company finds the market is a business, not simply an opportunity, then it will be interested. And STC is certainly a likely target of the OEM manufacturers, if not another possible entrant under its own steam. Both STC and EMM have established end user bases with sales and service in place.

Another bus system coming

Large new systems were scarce at the NCC, although National Semiconductor had its System 400 (EDP/IR,May 26) as the star of its ultra-modern plastic domed booth complete with flashing lights. However, the rest of the IBM plug compatible systems were absent.

But a new system was announced at NCC. Basic Timesharing Inc. changed its name to BTI Computer Systems, Inc. and plans to bring out a potentially very large, fast system dubbed the 8000. The 32-bit modular multiprocessor system is designed to support hundreds of terminals as well as batch jobs.

Based on what it calls Variable Resource Architecture, the system can handle up to 16 resource modules -- CPUs, peripheral processors and memory control units hung on the bus that transfers data at 60 Mbyte/sec. The system can be configured to fit particular needs such as heavy I/O or number crunching. A couple of features merit mention. A virtual multiprocessing monitor creates a virtual machine environment for each program independent of the mix of hardware modules and treats all hardware as a resource pool. Parts of a job may be assigned to different CPUs to ensure quick execution. An address-mapping unit in each processor translates virtual addresses into physical addresses in parallel with instruction execution, thus eliminating delays. The system is fail soft in a multi module configuration; a user removes the card at fault. Sysgen is automatic -- built in diagnostics check out each unit after a button is pushed and then configure the system.

The firm has applied for a patent on its process that scatters the contents of a page on a disk, thus allowing reconstruction of a page despite loss of a piece of data. This process consumes 10% to 15% more storage but contributes to reliability.

System size begins at $86,950 with a CPU, 256K memory, 33 Mbytes disk, a cartridge drive for software backup, eight user ports and a controller. Bundled software includes the system monitor, the command language, Pascal-x and utilities. Systems can range up to eight processors, eight parallel paths into 100 Mbytes memory, 32 I/O channels, 512 terminal ports and up to 128 spindles of 252 Mbyte disks. Languages available include Basic, Fortran and Cobol as well as Pascal; the compilers are written in Pascal.

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• ACTIVITY BECOMES RAMPANT at the low end of the disk line as several makers target the microprocessor-based system. Thus disappears into the annals of history another way in which a micro system could be distinguished from a mini -- micros didn't have hard disks. But then along came some independents who rigged up controllers for OEMs that wanted to put hard disks on their systems, and voila, suddenly the manufacturers have entered that market. On the larger disks, there are more bytes for the buck any way you look at the host of new drives announced this spring.

Among the notables is Shugart with its Winchester-technology small (physically) drives, products that are expected to wend their way into various Xerox items. Shugart will have an intelligent controller in the third quarter, when the drives become available. The controller will be able to link four SA4000 hard disk drives with four floppy drives. The new drives were designed for the performance range on IBM's Series 1, System/32 and System/34. DEC's 5- and 28 Mbyte drives will be supported by most of the firm's operating systems by June. The drives utilize an embedded servo technique. Data General's offering for its Micronova, the 6095, contains a controller and is supported by DOS. In the area of medium size disks, HP's 7906, a 20 Mbyte drive with the same price as the 15 Mbyte unit, has a fixed disk with double density and a removable with servo tracking. It is supported by software on the HP 1000 and RTE on 21MXs. In addition, the cartridges can be interchanged with those on the 15 Mbyte drive. DG rounded out its line of disks with a 50 Mbyte system.

	Shugart SA4000		DEC RL01	DG 6095	HP 7906	DEC RK07	DG 6067
Capacity	14.5	29	5	10	20	28	50
Transfer Time (Kb/sec)	889	889	512	312	7.5M (bits)	538	806
Drive $	2,550	3,500	3,800	--	10,000	10,500	14,800
Subsytem $			5,100	8,900	14,000	14,500	21,800
Drive/ Controller	4 + 4 floppy	4 + 4 floppy	4	1	8	8	4
Use With			11/03 PDP-11 PDP-8	Micro nova	1000s 21MXs	11/04 11/34-70 VAX	Nova Eclipse M/600

And then there's IBM, which again has most of the industry waiting to see what it has done to quadruple the disk capacity on the System/34. IBM has merely said the disks embody some "new technology." Whereas the previous maximum on a 34 was 27.1 Mbytes, IBM now offers 63.9- or 128.4 Mbytes. Average access time is 11 milliseconds faster, 27 msec and data transfer is now 1.031 Mbyte/sec vs. 889,000 byte/sec. Prices range from $36,900 to $59,750. Deliveries start January.

But International Memories Inc. didn't wait and simultaneously announced a Winchester-type drive using an 8 in. disk that fits into a floppy drive's space. Capacity up to 75 Mbyte is planned, but first models will be 11- and 24 Mbytes sporting an OEM price, including controller, of under $3,000. An 11 Mbyte unit has a transfer rate of 648K bit/sec. 3M Co. purchased a one-third interest in IMI. A Shugart spokesman conceded the new 34 disk may well be a small Winchester type, but said he prefers to wait for the specs before bringing a product to market.

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